The Foundry Trade Journal

AND

PATTERN-MAKER.

THE OFFICIAL ORGAN OF THE BRITISH FOUNDRYMEN'S ASSOCIATION.

Vol. 9. MARCH, 1907. No. 63.

—PUBLISHED—
THE FIRST WEEK IN EACH MONTH BY

EAGLAND & Co., Ltd.,
165, STRAND, LONDON, W.C.

Devoted to the interests and advancement of the Iron, Steel and Brass Foundry Trades.

Subscription Terms: 7s. 6d. per annum, post free.

To place the "Journal" within the reach of Working Moulders and Pattern-makers the Proprietors will accept subscriptions, not less than three in number from one shop, at the reduced rate of 5/- per annum, such order to be countersigned by the superintendent or foreman of the shop as a guarantee of good faith.

Any Subscriber having difficulty in obtaining copies promptly should notify the Publisher of the "Foundry Trade Journal," 165, Strand, London, W.C., giving the name of his local newsagent.

WE INVITE PRACTICAL ARTICLES ON THE TRADE IN ALL ITS BRANCHES, WHICH WILL BE PAID FOR. MSS. SHOULD BE WRITTEN ON ONE SIDE OF THE PAPER ONLY.

All communications to be addressed to the Editor, or to the Publisher, as the case may be, of

THE FOUNDRY TRADE JOURNAL,
165, Strand, London, W.C.

BRITISH FOUNDRYMEN'S ASSOCIATION.
LIST OF SECRETARIES.

General Secretary: F. W. Finch, Kingston House, Lansdown Road, Gloucester.
Manchester: C. Carson Bransby, 74, Winston Lane, Stretford.
Birmingham: F. J. Cook, 86, Milcote Road, Bearwood, Smethwick.
Cardiff: R. Griffith, Messrs. J. Williams & Sons, Ltd., Globe Foundry, Cardiff.

THE NEW FOUNDRIES OF THE HOLWELL IRON COMPANY, LIMITED.—I.

THE HOLWELL IRON COMPANY, LIMITED, who have been pig-iron manufacturers for about a quarter of a century, decided some time ago to enter the lists as iron-founders on a large scale, more particularly as makers of cast iron pipes. The works have built up an excellent reputation as makers of foundry pig-iron, and their situation—about one and a-half miles from Melton Mowbray—gives them good facilities for reaching a variety of markets. Moreover, the blast furnaces have their supply of iron ore assured for many years to come from mines within a radius of 12 miles, while the southern extension of the Nottinghamshire coalfield has brought fuel supplies equally near.

The history of the discovery of these iron ore deposits, which are the mainstay of the industry, is of interest. They have been known for about 33 years. Mr. Dalgliesh, the present managing director, was at the time a civil engineer on the Midland Railway, and happening to be engaged in taking a set of levels through the Melton Mowbray district, discovered in the course of his survey that the land contained ironstone. Some months afterwards Mr. Dalgliesh, seeing a farm advertised for sale in the district, spoke to his friend Mr. Howard A. Allport, of Barnsley, about it, with the result that they joined together and sunk trial holes. Samples were sent to London for analysis, which proved the ore to be of value. A company was then formed to mine the ore. The ironstone mines are at Kettleby, a distance of a few miles from the works. In addition, the Company also hold the royalties at Eaton and Buckminster, under the Duke of Rutland and the Earl of Dysart.

Soon afterwards, when the stone was proved useful for smelting, the Derbyshire firms of iron smelters came into the district and took up royalties. The sale of the Holwell Iron Company's ironstone

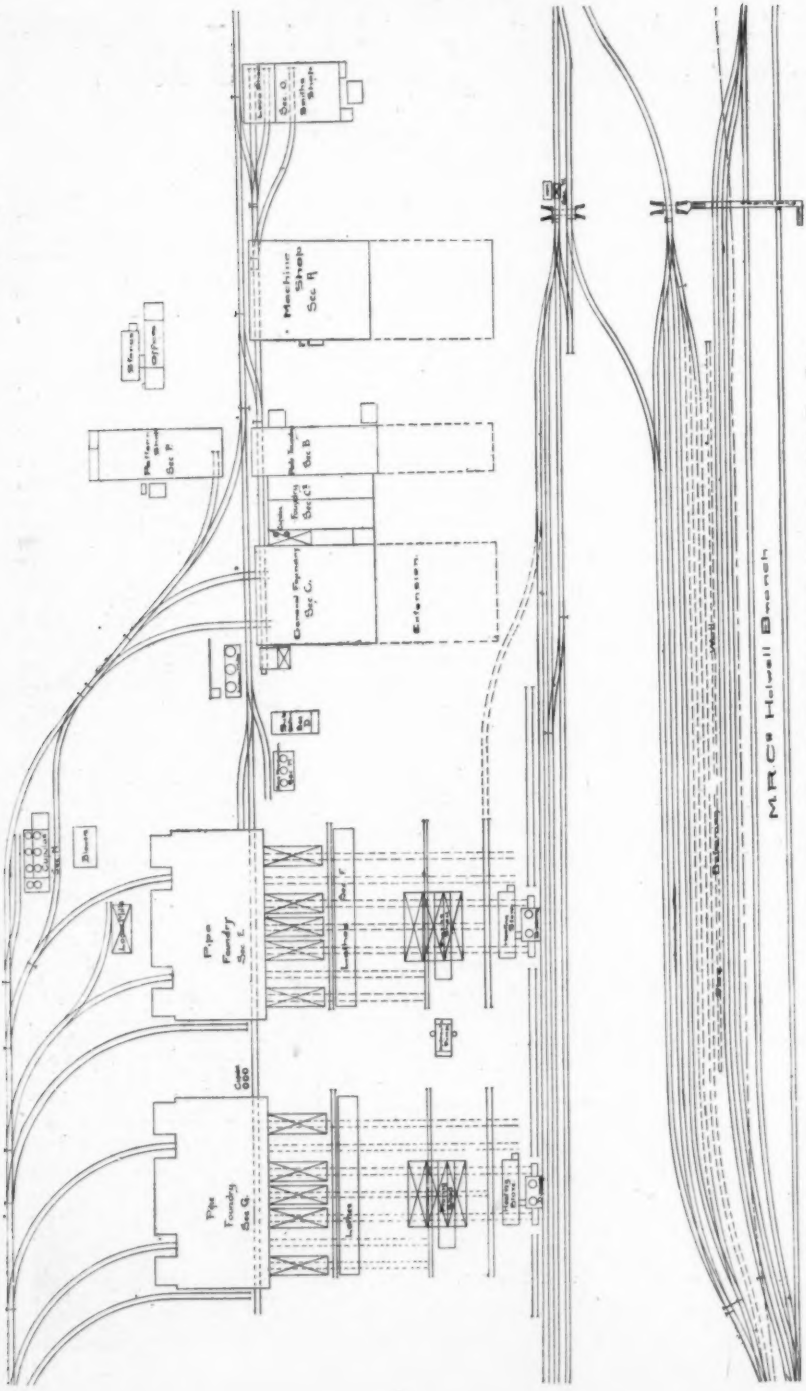


FIG. 1.—PLAN OF THE NEW FOUNDRIES OF THE HOLWELL IRON CO., LTD.

being practically under these circumstances brought to an end, it was decided to build blast furnaces and bring the fuel to the ironstone, in opposition to the firms who had now commenced to take the ironstone to the fuel. The Company in the meantime had been acquiring large royalties of ironstone.

The first blast furnace was put into blast in December, 1881. Commencing with this one furnace the plant has now increased to four furnaces, having a capacity of 2,500 tons per week.

As will be seen from Fig. 1, the general arrangement of the foundries is a series of buildings with rail tracks running right through them from end to end. The principal feature in their design is one which is always aimed at nowadays, namely, that the raw material shall enter at one end and leave as finished material at the other after the necessary cycle of operations. We shall proceed to describe the various shops in order.

Smith and Boiler Shop. (Fig. 3.)

This is a brick building 60 ft. square, with a light wood roof supported on iron columns. There are nine hearths, which are all provided with brick chimneys and are arranged along the walls of the building. The roof is well glazed, affording plenty of light in the daytime. By night arc lamps are used. The equipment consists of the usual punching machines and bending rolls. The steam hammer is by Davis & Primrose, and is driven by compressed air. The fans for the forges are electrically driven, and are housed in a separate building. They are by the Sturtevant Company and W. J. Jenkins & Company, of Retford.

Locomotive Shed and Testing House.

These buildings adjoin the smithy. They are 40 ft. by 60 ft. The testing house is a department that is much used, a careful watch being kept on all materials. Although an additional expense, experience has shown that the money is in the end economically spent. A test is taken from every cast, and the transverse strength determined on a Denison testing machine.

Machine Shop. (Figs. 4, 5 and 6.)

This is a substantial brick building in two bays each 120 ft. long by 45 ft. wide. Each bay is provided with a 10-ton electric overhead crane of the three-motor type, built by Joseph Booth & Bros., of Rodley. These cranes have a longitudinal travel of 300 ft. a minute, and a lifting speed of 20 ft. a minute, with a 10-ton load. The railway tracks run through the building and on to the foundries. The roof is of steel, with a patent glazing

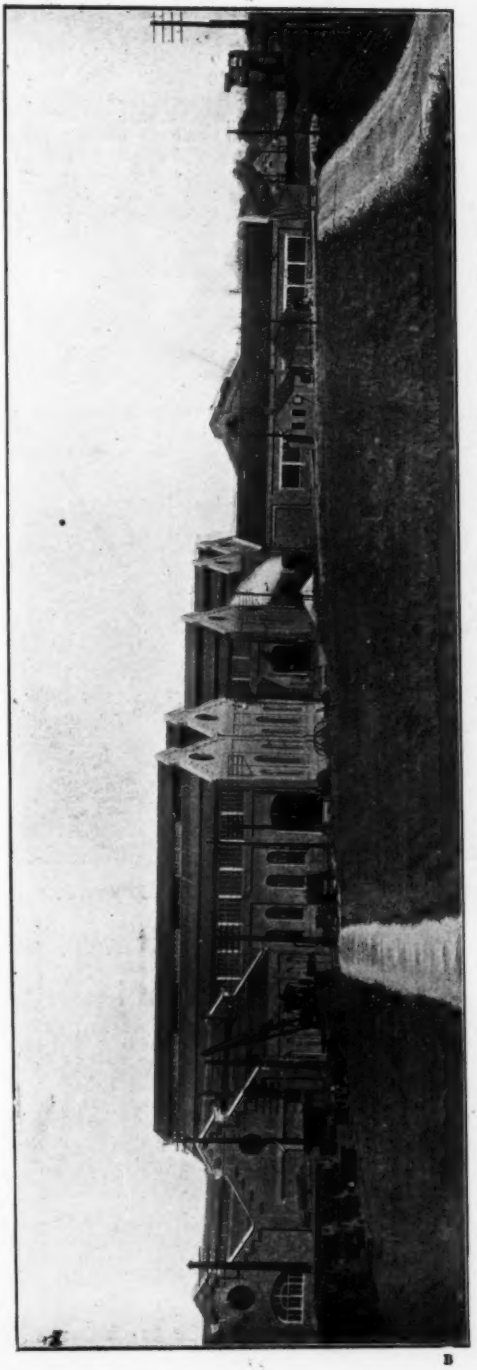


FIG. 2.—GENERAL VIEW OF THE NEW FOUNDRIES AND ENGINEERING SHOPS; HOLWELL IRON CO., LTD.

which makes an exceedingly light shop, especially as the glazing starts at the crane track and is carried up to the eaves. Each roof has a double row of skylights. The floor is made of wooden blocks 9 in. by 3 in. by 4½ in. deep set on concrete. This has been found satisfactory and easy to keep clean. The equipment is practically all new, and embraces several planers. One takes 7 ft 6 in. square by 22 ft. long; another 4 ft. 6 in. square by 18 ft. long; while a third takes 2 ft. 6 in. square by 4 ft. long. The planers are built by Redman & Company, of Halifax.

There are the usual lathes, screwing machines and radial drills. One feature is the facing machines by Geo. Richards & Company, of Broadheath. These are used for facing all special pipes. Of this class of work there is a great deal, it being the rule to mill small pipes and specials and to plane the larger sizes.

The foreman's office is well elevated above the machine shop floor, and thus gives a commanding view of the shop. For timekeeping the International Recorder system is used. In addition to checking the men's time, the system is used for the cost sheets, the men checking the time on each job.

The shop is electrically driven, each tool being independently served, thus ensuring an absence of all line shafting.

Air Compressor House.

This house contains a 45-h.p. motor driving an air compressor made at these works for the pneumatic tools in the fettling yard. The air pressure is 80 lbs. per square inch.

The Central Cupola Plant. (Fig. 7.)

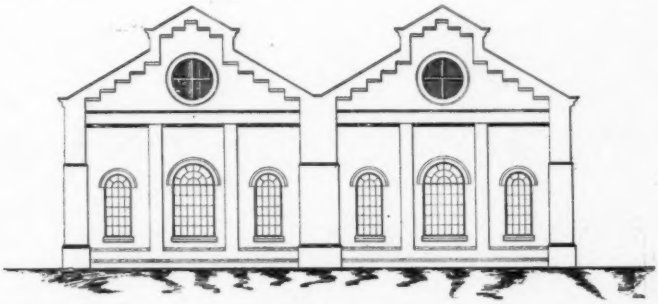
The cupolas are notable in two ways. In the first place they are probably the largest in use for foundry purposes in this country, and in the second they are built entirely apart from the foundries themselves. They are a centrally located melting plant supplying hot iron to all three foundries. Because the Holwell Iron Company are iron smelters, an impression might possibly exist that direct metal is used for their castings. This is not the case, all the metal being remelted. There are two cupolas, each melting 12 tons an hour. The cupolas were made by Messrs. Horning, and are of the Greiner & Erpf type, with upper tuyeres. The cupolas are open-topped, and similar to a blast furnace, and it will be seen that the plating finishes at the level of the charging floor. An electric overhead travelling crane hoists up the charge and drops it into the cupola. Owing to the construction of Greiner & Erpf no inconvenience is caused by the cupola being cut off at the charging hole. Even when

FIG. 3.—SMITH AND BOILER SHOP; HOLWELL IRON CO., LTD.

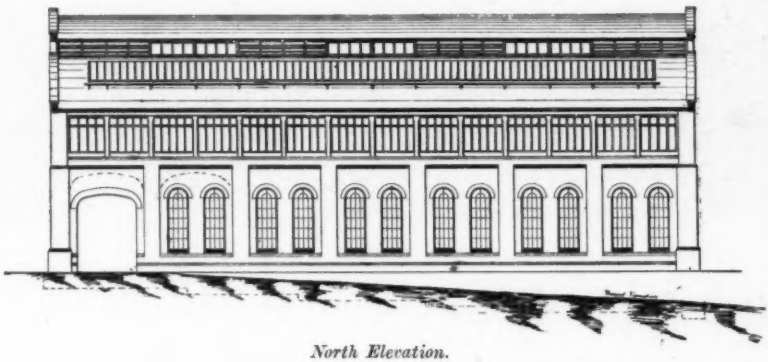
the cupolas are working at full pressure of blast it is possible to stand on the top of the charge. The cupolas are fitted with a drop bottom and a receiver. The great variety of uses to which the metal is put results in a variety of sizes of ladles, which range from 30 cwts. up to 10 tons. Each foundry is connected by standard-gauge rails to the cupola melting plant, along which the ladles run.

house, in which two No. 6 blowers, made by Thwaites Bros., of Bradford, are installed. These blowers are electrically driven, and are regulated by a street car type of controller.

The coke shed also adjoins the cupolas. All coke is analysed before use, a feature which has been found most beneficial. It is a rule that all coke over 0.75 to 0.80 per cent. of sulphur is rejected, and the



East Elevation.



North Elevation.

FIG. 4.—MACHINE SHOP; HOLWELL IRON CO., LTD.

The ladles are made by Dewhurst, of Sheffield, and J. Evans & Company, of Manchester. As will be seen from Fig. 7, the cupolas are carried on a steel framing on the top of which runs the 5-ton electric crane. The charge is put into small bogie wagons and hoisted direct into the cupola. In addition to these central cupolas there are others connected with the smaller foundries.

Adjoining these cupolas is the blower

analyses have been invaluable in securing a standard quality. Close to the cupolas the stocks of iron are kept, including hematite for special castings with less than 0.02 per cent. sulphur.

Plate Foundry. (Fig. 8.)

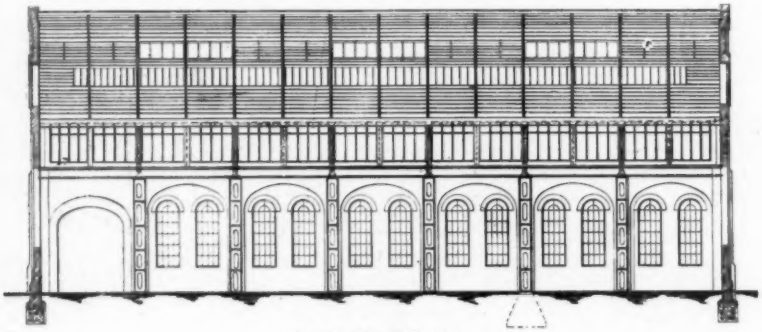
The machine shop is generally known at the works as Section A. Section B comprises the plate shop, which is principally used for casting tubbing plates

and segments. This foundry is the same length, viz., 120 ft., and the same width as the machine shop, and the roof is the same in every detail. The overhead crane is a 10-ton electric one. By having all the bays of the various buildings of the same width, the cranes are all of the same span. Breakages can thus be easily replaced, with a great saving in stocking spare parts. In addition to the overhead crane there are five hand jib cranes.

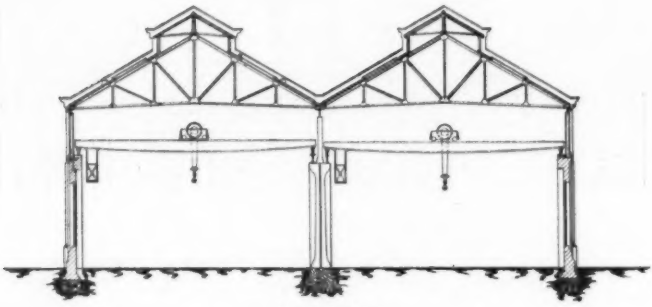
travelling cranes run from one end of the works to the other. The fettling yard is provided with a full equipment of the Boyer type of tool for chipping, the air being delivered by flexible pipes from an electrically-driven air compressor made by Reavell & Company, Limited, of Ipswich.

The Small Foundry. (Fig. 9.)

Between Sections B and C a small general foundry has lately been erected.



Longitudinal Section.



Cross Section.

FIG. 5.—MACHINE SHOP; HOLWELL IRON CO., LTD.

The stoves are heated by producer gas from a centrally located producer plant, which supplies gas to all the stoves and core ovens, being piped all over the plant in underground mains.

The fettling gantry is a yard situated between Sections A and B, that is between the plate foundry and the machine shop. This yard is commanded by a steam travelling jib crane. It may here be mentioned that two 5-ton steam

This is for small castings up to 8 cwts. The building is in two bays of 30 ft. each by 120 ft. long. Molten iron is supplied by two cupolas by Messrs. Thwaites Bros., Limited, of Bradford, melting 4 tons per hour. The blower is also by the same makers. They are fitted with drop bottoms, and have three rows of blowing tuyeres. The hot metal is taken from the cupolas by means of an overhead runway made of joists suspended on hangers.

This is of the usual type. For this class of work these overhead runways are coming much into favour. The runways are fitted with several blocks of special design, and are fitted with points and crossings so that the blocks can be used on either of the runways as desired, the arrangement being that the runway reaches all parts of the shop. This foundry is arranged with temporary ends to the building, so as to be easily extended. Like all the other shops, it is well lit. It is known as Section C 2.

(To be continued.)

FIG. 6.—MACHINE AND ERECTING SHOP; HOLWELL IRON CO., LTD.

—o—

MR. J. BARBOUR, senior director of Fairbairn, Lawson, Combe, Barbour, limited, engineers, died recently. The deceased gentleman was the senior director of the old firm of Combe, Barbour & Combe, Limited of Belfast, and when that firm amalgamated with Fairbairn, Macpherson's, Limited, and Samuel Lawson & Sons, Leeds, in 1900, he was made a director of the combined company.

BRITISH FOUNDRYMEN'S ASSOCIATION.

The Birmingham Branch.

A MEETING of the Birmingham Branch of the British Foundrymen's Association was held at the Technical School, Suffolk Street, on Saturday evening, under the presidency of Mr. Hiorns, when a paper was read by Mr. O. F. Hudson on "The Microscopical Testing of Cast-iron." There was a good attendance.

MR. HUDSON said the object of the paper was to give some account of the structures commonly met with in the microscopic examination of cast-iron. Careful preparation was necessary, and the specimen should, where possible, be sawn from a piece of the metal, and filed, bevelled, and the file scratches removed. Microscopic examination was now universally recognised as of great practical utility. For polishing a specimen the lecturer suggested alumina as better than rouge. For etching, 2 per cent. of nitric acid, and 10 per cent. of picric acid were useful, and the specimens should be rubbed lightly on wet parchment specially prepared to remove the stain or tarnish. The lecturer

proceeded to describe the various constituents found in different classes of iron. The character of iron was determined principally by the form in which carbon occurred, and this was greatly controlled by other impurities. The lecturer concluded by an exhibition of micros of castings, showing how the mixtures of pig, and the casting conditions and rate of cooling modified somewhat the previous structures.

A discussion followed.

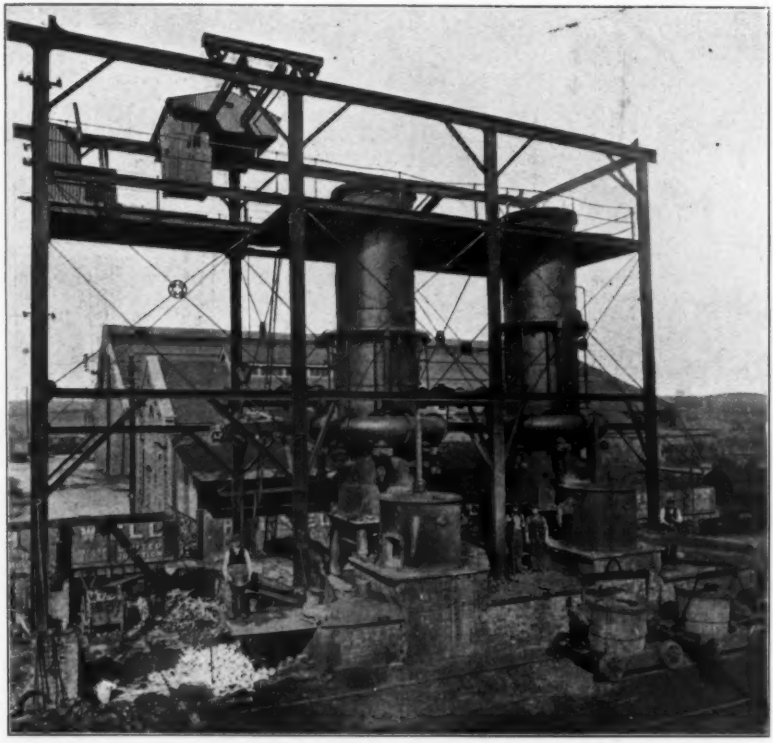


FIG. 7.—THE CENTRAL CUPOLA PLANT; HOLWELL IRON CO., LTD.

The CHAIRMAN complimented Mr. Hudson on his excellent paper and beautiful slides, most of which were his own. Another trade was springing up which promised to be a serious rival. This was the production of steel castings, the number of which were increasing enormously. A great number of firms were substituting steel for iron castings. It seemed to him that the iron moulder did not appear to be what he should be at the steel works. He ought to be able to deal with steel castings as well as iron, because it looked like being a matter of vital interest to their trade. His work was not only art, but science as well, and they must have a fair knowledge of both. Science would greatly help them in solving those problems associated with iron and steel castings.

MR. WILKINSON (West Bromwich) said the lecturer had mentioned that the phosphide eutectic was the last constituent for solidifying. He would like to know what effect quick cooling would have on phosphorus, and whether sulphur and manganese contracted under the microscope.

MR. HUDSON, replying, said the structure generally would be smaller in quick cooling, and the parts would be more broken up. Manganese by itself had no effect on the microstructure, except that it combined with the sulphur, and manganese sulphide might be detected by the micro-

scope. It was fairly easy to distinguish, although somewhat of the same colour. Manganese was light, but when compared with sulphur it was somewhat lighter.

MR. F. J. COOK said the paper had thrown considerable light on the subject, and would be very helpful to members. With regard to some of the slides, he would not have recognised some of the blotches as temper carbon. He would have expected to find something smaller, and he would like to know whether temper carbon was denoted by size or by formation. He had always understood that temper carbon was the carbon separated from the iron during the annealing; so far as the effect on the properties of iron was concerned it was a very small matter whether it was temper carbon or carbon. During the cooling process of cast iron temper carbon might attach itself to the existing blocks of graphite, or be formed in their immediate neighbourhood, and so be hardly noticeable.

MR. MASON wished to know the actual size of the actual specimen used for magnifying.

MR. HUDSON replied that the pieces

FIG. 8.—PLATE FOUNDRY (SECTION B.); HOLWELL IRON CO., LTD.

could only be got in cast iron by annealing, as in malleable iron. He had tensile bars up to 18 tons, and thought he should have found some, but on magnifying up to 2,000 it was found that the shape of the carbon was fluky and not sound, and he could find no temper carbon at all.

MR. HAILSTONE thought temper carbon was a very erroneous term to give to cast iron. He had examined 500 or 600 specimens, and had never found any temper carbon. He had always seen graphite as plates, but, on the other hand, after annealing, he had had no difficulty in seeing the temper carbon, which came out on the top of the cementite.

MR. HUDSON replied that temper carbon would be about one-twentieth part of an inch, and they had been magnified 60 times.

MR. WHARTON pointed out that if silicon drove out carbon, and sulphur retained it, the character of iron might be very much altered by the different methods of moulding. He would like to know also how far blast would affect it. As to steel moulding he had worked in a steel foundry, and he believed the best moulders there were those who had previously worked in iron. Those trained to steel castings were duffers in iron work. But, on the other hand, iron moulders could go from one branch to the other without inconvenience.

MR. COOK, replying to the question as to sulphur being increased by higher blast,

said the increase was hardly perceptible. Without a higher pressure the carbon got less.

Mr. Hudson remarked that the effect of re-melting iron was to slightly increase the sulphur, but to decrease the silicon.

The Chairman added a few remarks on temper carbon. "Do not," said he, "call it temper carbon, and then you are all right." It was, he added, hard to say which was graphite. It might be said to resemble somewhat a small worm, a small starfish, or a blot of ink on a piece of paper. But it really did not matter. There was only one carbon, but the size of that carbon determined the strength of the section. When the large plates of graphite were split up into a number of plates, it gave strength.

The proceedings concluded with hearty votes of thanks to the lecturer and the Chairman.

Fig. 9.—Small Foundry (Section C 2); Holwell Iron Co., Ltd.

—o—

R. & W. Hawthorn, Leslie & Company, Limited, Forth Banks, Newcastle-on-Tyne, have acquired the chief part of the adjoining works formerly occupied by Messrs. R. Stephenson & Company, for extensions to their locomotive works.

GLUTRIN.

This is a new binder which is being introduced by Messrs. J. W. Jackman & Company, Limited.

Glutrin should be mixed with at least an equal volume of water before being put on the sand. If the sand is not too damp, two, three, four, or five volumes of water may be used; the thinner the binder, the better the mixture and the smaller the amount required. The water is added so that the liquid may be thin and fluid enough to easily, quickly, and thoroughly penetrate the mass.

Glutrin is used in proportions varying from 1 part of glutrin to 150 parts of sand by bulk, up to 1 part of glutrin to 20 parts of sand. This refers to the actual amount of glutrin used and not to the glutrin and water mixture. It has been found in practice that the most satisfactory proportion is usually 1 part of glutrin to 50 parts of sand, *i.e.*, half a bucket of glutrin mixed with half a bucket of water to 25 buckets of sand,

It may be varied as the hardness and strength of the cores indicate. When the sand is full of clay or very loamy, a smaller proportion of glutrin will be required.

If too much glutrin is used the cores are very hard after baking, and, therefore, very difficult to clean from the casting. Glutrin-made cores will bake or dry at a low heat and in a short time. For cores that are to be cast the same day as set, such drying will be satisfactory, as there can be no "blowing" with this binder. Cores that are to stand in the mould over night or longer, or, in other words, that must be damp-proof, should be heated to 500 degrees Fahr., about the melting point of solder. Glutrin gives off practically no smoke or gas, so that there is no danger of "blown" castings.

Cores made with glutrin will neither contract nor expand on baking, and, therefore, the cored hole will always be true to size. The lack of gas reduces the amount of venting usually required, and the extra strength removes the necessity for the large number of rods, nails, etc., that are so generally employed.

An additional saving, and, in many foundries, a great convenience, arises from the fact that not only may a very large proportion of old sand (floor sweepings, etc.) be used in the core-sand mixture, but the actual old core sand (the sand that comes out of the castings or cleaning) may be used over and over again by simply adding, say, 10 per cent. of new sand, and more glutrin and water. Diluted glutrin when mixed with 10 to 20 per cent. of linseed oil, before mixing with the sand, makes radiator cores without rods. Pipe-founders will, it is claimed, find glutrin superior for a mould and core wash to the mixture of blacking, molasses, and water, which is often used.

In some steel foundries it has been proved to be good practice to mix the moulding and core sands with molasses and water. Half the quantity of glutrin substituted for molasses gives good results.

——o——

THE LONDON AND NORTH-WESTERN RAILWAY COMPANY have added an engineering department to the Crewe Mechanics' Institution, to which apprentices in their railway works receive practical instruction in mechanical engineering, attendance counting as if they were on duty in the works.

BRASS CASTINGS.

AT a meeting of the Pittsburg Foundrymen's Association, held on January 7 last, a paper on "Brass Castings" was read by Mr. J. L. Jones, metallurgist in the research department of the Westinghouse Company, of which the following is a brief abstract :—

At the present time brass foundries often rival iron foundries in size and equipment. In most of the larger plants, crucible melting has been supplanted by the use of oil-burning furnaces of the Schwartz and other types, with the result that the melting is done for about one-half the cost of crucible melting, and the melting losses are only about one-half the losses experienced when crucibles are used. To obtain these results, experience and careful handling are required. Any alloy or metal used for making castings from copper down to aluminium or zinc can be successfully melted in an oil-melting furnace, and the use of such furnaces is one of the most striking advances that has been made in brass-foundry practice in recent years.

Moulding Sand.—In the making of brass castings, the selection of a good moulding sand is of first importance, and should be chosen to suit the work in hand. Brass sands, as a rule, differ little, if any, from the sands for making iron castings. If anything, they are rather inferior to iron-moulding sands. Brass, having a lower melting point than cast iron, requires a less refractory sand, and considerable amounts of mica and other slag-forming materials may be present in a brass sand, especially if the castings are light. The well-known French sand used for statuary work surpasses all moulding sands in toughness and "body," although both its chemical and physical composition differ but little from that of standard Albany sand. Possibly the unusual qualities of French sand are due to the great plasticity of the clay, which bonds its grains together. The high price of the French sand renders its use prohibitory for most work.

Some brassfounders make a practice of adding common salt to the water used for tempering moulding sand, using about four ounces to a bucket of water. The only advantage derived from the use of salt is due to its taking up moisture and making the sand stick together, so that it will not wash before the molten metal, and hence give a smooth casting. The use of much salt will prove detrimental,

as it adds a fluxing ingredient to the sand and makes it liable to burn on a casting.

Metal Used for Making Brass Castings.—Of the metals used in making brass castings, copper, tin, zinc, and lead are the most important, and they rank in the order named. Other metal, such as aluminium, nickel, iron, manganese, antimony, and magnesium are sometimes used, as are the metalloids, phosphorus and silicon.

Copper.—Copper is generally used in the ingot form. As the best brands of lake copper are largely bought up by the wire-makers, electrolytic copper has to be used now by many founders who would much prefer the lake copper. The best grades of electrolytic copper are, however, equal to, or superior to, the best grades of lake copper.

The best method of ascertaining the purity of copper is by taking its conductivity. High-grade lake and electrolytic copper runs very close to 100 per cent. conductivity and analyses 99.9 per cent. copper.

The conductivity of annealed copper is about 2 per cent. greater than when it is hard-drawn or hammered cold. A specification that required high-grade lake or electrolytic copper to have a conductivity of 97 per cent. hard drawn and 99 per cent. annealed would shut out all inferior brands. Casting brands of copper for ordinary work could be bought on a basis of 99.5 per cent. metallic copper.

Tin.—This metal has been increasing in value so rapidly that all brass-makers are hunting something to replace it. Straits tin is the best, and, perhaps, in the long run, the cheapest that can be bought. There are various brands of cheaper qualities of tin on the market. English brands have a good reputation, and next to Straits are to be preferred because free from antimony and arsenic. Bolivian tin contains, as a rule, too much antimony to be used for castings, but it may be refined to a high degree and rendered more acceptable.

Spelter or Zinc.—The brands of zinc known as prime western spelter are good enough for most classes of brass castings, as they seldom contain more than 1 $\frac{5}{10}$ per cent. of lead and only traces of other impurities. In some Government mixtures that required unusual strength, Butha and similar grades of zinc that are free from lead must be used. Slabs of zinc that have a fine grain may be suspected of having been made from kettle-refined dross and of containing considerable iron. There has been recently put on the market several brands of zinc that are made from the direct distillation of galvanisers' dross. Some of this zinc is extremely pure, but it has not found a very ready market because a much higher price is asked for it than prime western spelter brings.

Lead.—It is generally thought that all brands of soft lead contain only traces of impurities, and are equally good. But brassfounders who watch their losses carefully will find that the melting loss on some brands is only about $\frac{1}{4}$ of 1 per cent., while on others it may exceed 3 per cent. Some brands are made from argentiferous or silver-bearing ores, and others from non-argentiferous ores. The brands known as "Chemical leads" usually give the most loss in melting. Freedom from dross and oxides rather than analytical purity is what the founder wants in his pig lead.

Brass Mixtures.—Mixtures for brass castings are so numerous that one can only touch the high spots in speaking of them.

Red Brass.—Of the mixtures of red brass that are in use, few, if any, can compare with the well-known "88-10-2" for all-round excellence. This consists of 88 parts of copper, 10 of tin, and 2 of zinc. For general fittings, machinery castings, valves (especially large valves), condensers, steam pipes, etc., it gives very good results, as it is strong, tenacious, and runs well in casting. For Government work this mixture is required to be free from lead, as lead greatly decreases the tenacity of castings both when they are cold and hot. Lead is usually supposed to be added to brass mixtures in order to make the castings machine easily. It does this because it decreases the strength of the metal. The quality of brass castings would be greatly benefited if lead were banished from the brass foundry entirely, although there are some bearing bronzes in which its use may be necessary.

Yellow Brass.—The Government mixture of 67 parts copper and 33 parts zinc is about as cheap a yellow brass mixture as any. Its running qualities are improved by a little tin, which also stiffens it up, for it is rather soft. It is the practice in some localities to add aluminium to both red and yellow brass in order to improve its running qualities, but conservative brassfounders prefer to

keep aluminium out of their foundries, especially where castings have to stand an air or water test.

Scrap.—Where no strength is required, scrap can be used to advantage, and it is customary to load it up with all the lead it will stand in order to cheapen the product. Scrap, if free from iron, is really better than new metal as far as uniformity is concerned, because the remelting amalgamates its constituents and thus improves it.

Phosphor-Bronze. — Phosphor-bronze usually consists of copper, tin, and phosphorus, and it is an unwritten law that zinc must be kept out of it. In some foundries phosphor-bronze is made by throwing a small stick of phosphorus an inch or two in length into a crucible of metal, when it is brought from the furnace. The phosphorus floats about on the surface and burns, doing the metal little, if any, good. Others go to the opposite extreme and use from 1 to 2 per cent., with the result that segregation and blowholes occur in the castings. One pound to the hundred will usually thoroughly deoxidise the metal, unless it is very dirty. Phosphor-copper is much to be preferred to metallic phosphorus, as the latter is uncertain in its action, and dangerous to handle. It may be rendered less inflammable by putting it in a solution of blue-stone, and thus coating it with copper. Phosphor-copper may be had on the market up to 15 per cent. phosphorus, and it gives a stronger, tougher, more uniform alloy than when phosphorus is used, and the sand does not burn on the castings to such an extent.

The standard mixture for bearings consists of copper 79.70, tin 10, lead 9.50, and phosphorus 0.80.

Lead Bronzes. — Various mixtures which contain as high as 30, and even 50 per cent. of lead are being recommended and used to some extent for bearings. They do not give as satisfactory results as standard phosphor-bronze, being deficient in strength. This lack of strength combined with lack of ductility causes the bearings to flake. These alloys also are difficult to handle in the foundry.

Copper Castings.—What are called "pure" copper castings are usually required for electrical use, and must not only be sound castings, but possess high conductivity also. Both these requirements may be attained by casting high-grade electrolytic copper into metal moulds, but this method can only be used where the castings are plain and wanted in large numbers. In most cases the castings must be made in sand, and this renders it necessary to add some deoxidiser to the molten copper in order to secure a casting free from blowholes. If an excess of the deoxidiser is added, the conductivity is lowered. Silicon has proved the best material to use, but on account of its high melting point it is added preferably as silicon-copper containing 10 per cent. of silicon. The makers of copper castings should make it a rule to select one brand of copper and use no other, for the more brands he uses the more variables he introduces into his practice, and the less likely is he to obtain castings of high uniform conductivity.

Manganese Bronze.—There is a large and increasing use of this alloy for automobile castings and other sections where cast brass is not stiff enough. The making of castings from manganese bronze offers no special difficulty if it is remembered that its shrinkage is unusually high. It runs well, and thinner castings may be made from it than from yellow brass. On account of its great strength, the weight of castings may often be cut in half, by using it instead of red or yellow brass. On account of the large amount of zinc it contains it is liable to run scruffy, and for this reason it is necessary to bottom-pour all castings. The mixing of manganese bronze is a difficult operation, and it is best for the small user to buy his ingot. A number of brands of manganese bronze are on the market, some of them being of excellent quality, and others far from satisfactory.

Ventilation.—The tendency in present foundry practice seems to be toward brasses containing more and more zinc, and toward the use of oil-melting furnaces instead of the old crucible furnaces. The aim in all oil-melting furnaces is to obtain perfect combustion, producing the maximum heat from the oil consumed. When this is done only carbon dioxide gas is discharged from the furnaces. This gas is not poisonous in the ordinary acceptation of the term, except as it vitiates the air of the foundry. Under actual working conditions, however, combustion is far from perfect, and large volumes of the very poisonous carbon monoxide gas are often discharged from the furnaces. The fumes of zinc oxide which come from the furnace and from the pouring crucibles often give trouble in the winter season, when windows have to be kept closed. Poisoning by zinc is

known among the workmen as "spelter shakes." The symptoms that may be produced are coughs, stomach trouble, paleness, and a dirty grey skin, with blindness at night and chills. After a time there is developed a kind of paralysis and tremulous movements of the body.

When a foundry is large and roomy the gases and fumes seldom give trouble. When possible, they should be removed by down-draught ventilation, because both carbon monoxide and dioxide are heavy gases, while zinc oxide and the other metallic fumes are heavier yet. Most of the larger brass foundries provide excellent wash-rooms and even shower-baths. The men should never be allowed to eat their lunches in the foundry unless it is absolutely necessary. The hair, beard, and nails should be kept short, so as not to take up the dust, and respirators may be worn by the men pouring off.

——o——

A NEW FOUNDRY FLASK.

All foundrymen are familiar with the shortcomings of the snap flasks, and know how frequently snap flask work is spoiled on account of run-outs which result not only in loss of castings, but in burning of the bottom boards. To overcome these difficulties the MacPhail Flask and

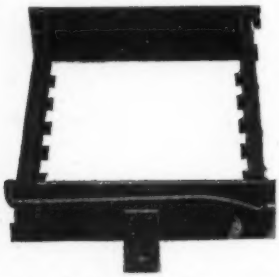


Fig. 1.—Cope of MacPhail Flask.

Machine Company, 1,270, Monon Building, Chicago, has brought out a new form of flask, which is shown in the accompanying illustrations. It is made entirely of sheet steel. Cope and drag have a uniform taper toward the bottom board. To hold the sand in the cope while it is being turned over, a series of projecting lugs or fingers are provided near the parting line of the flask: these are controlled by the levers shown at the ends of the cope part of the flask. By depressing the levers a short distance, the lugs are withdrawn, thus releasing the sand. After the mould is completed the sand is released, and the flask, on

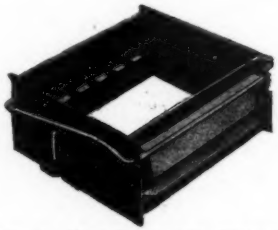


Fig. 2.—The Cope and Drag of MacPhail Flask Complete.

account of its taper form, easily lifted off.

To support the sand during pouring a sheet steel jacket, made of metal of the same thickness as the flask, and having exactly the same taper, is dropped about the mould. This supports the sand perfectly at all points and makes it possible

Fig. 3.—Jacket Used in Connection with MacPhail Flask.

to place the casting very close to the outside edge of the flask. In other words, this arrangement gives the advantage of a complete steel flask without its attendant expense.

The jackets can be readily removed from one mould to another so that it is claimed that where 125 moulds per day are put up on a machine, it is only necessary to have one of the MacPhail self-releasing flasks and six steel jackets. The jackets being self-releasing are moved from one mould to another as they are successively poured.

——o——

Messrs. H. A. Davies & Company, engineers, Sunderland, have added an engine shop to their works.

"HOW I SIMPLIFIED THE MAKING OF A ROLL CORE."

By G. M. R.

The cores in question were about 7 in. diameter by 14 in. long for rolls with internal bosses, and had been made in a complete wood core box formed (as shown in section at Fig. 1) of four parts, *i.e.*, the barrel part in two halves and a cup for each end forming the bosses. The making of a core from this used to take a man an hour each.

The rolls being necessarily cast on end, I set to work as follows:—Took one end piece of the old core box and permanently fastened to same half the length of the barrel part, as shown in section at Fig. 2, from which it can be seen the making of half a core is a very simple

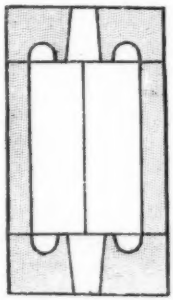


Fig. 1.

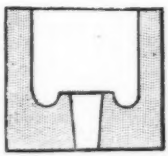


Fig. 2

matter, and the two half-cores placed one on the other to form a complete core, are now made by a lad in half an hour, and at less than one-fourth the cost, fully justifying the trifling cost of alteration. This is not the only advantage, as there is now only one piece to take care of instead of four previously, and only half the space required for storage. These seem to be points overlooked by some pattern-makers, but I am convinced that many core boxes are much more complicated and require much more time to get a core from than there is any necessity for, and take a great deal more space than they should do.

—o—

The shipyard of the late Mr. W. Walker at Maryport, has been fitted up as an engineering works, and in future will be known as the Solway Engineering Works.

ELECTRIC SMELTING FOR THE FOUNDRY.

The following letter from Dr. Moldenke appears in "Electrochemical and Metallurgical Industry":—For some time past foundrymen have been interested in the developments of electric smelting so far as it might be applied to their industry. As the necessary information as to whether iron may be melted in a commercial way can only be given by our electrical friends, perhaps a few remarks on the requirements involved may be of use to those who have apparatus and process adapted for foundry work.

The average foundryman of to-day has constant calls for steel castings along with his regular routine work in grey iron. This, on account of the rapid introduction of the steel casting into machine construction. These steel castings he must sub-let to the steel foundries. The latter are looking for tonnage, and do not like to fill up with small quantities of comparatively light work. Hence, high prices, which cut the foundryman's profit. In a similar way the foundryman has to deal with malleable castings. The malleable castings founder has both steel and grey iron put up to him, and it may not lie very far in the future when the steel founder may be asked to produce both grey iron and steel castings along with his steel. It is to be understood, of course, that this is all brought about in making contracts with concerns who place their work by the year, or the thousand tons, be the castings what they may during the period of contract.

Now, very few foundrymen are equipped for this. They strive to place these outside lines with other people at the smallest loss to themselves. Yet if there were a convenient and easily operated process, many of them would instal it immediately to take care of just such conditions.

The smelting, or rather plain melting, of iron electrically has always seemed to me ideal in its way. We do not want to produce chemical changes in our mixtures if we can help it. We want only to melt quick, produce very hot iron, and punish the metal as little as we can. Every time we melt the metal under present conditions we hurt it somewhat, the degree of the damage done depending upon a number of conditions, both chemical and physical. We counteract

this by additions of steel to reduce the total carbon, or selecting the silicon content in such a way that with the reduction in this element incident to the process, a strong iron results. If, however, we could have a process which in no way changes the composition, we could put into the melt just what we want out of it, and one of the serious difficulties of foundry metallurgy would be solved. Again, if we could regulate the temperature in such a way that the iron is not overheated while melting, but can be heated up very high afterwards, we could obviate the oxidation of the metal during the melt, and in addition remove any existing evil of that kind by the use of ferro-manganese in the melt when it has been brought to practically a steel temperature, at which point the ferro-manganese will do its work.

The induction furnace, it seems to me, fills these requirements, and I would like to see more work done along this line for the foundry. I may be in error, but it would seem to me that scrap of all kinds, properly selected, is all that need be melted, cleaned by some ferro-alloy, and then cast in the usual way. The enormous steel production will always yield scrap enough to supply the demand for small steel castings, once a process of this kind can be made to work commercially, and I would be very glad to be of assistance in bringing a process of this kind to the attention of the foundry world.

Taking the non-ferrous metals. A brass foundry would have abundant use for an electric smelting process, if run on the lines laid out above. The melting loss in the brass foundry in zinc and tin is a great one, and one that runs up into money quickly. A clean, wasteless process, as the electrical one should be, would be a boon to the industry. There are many foundries which could melt within short periods of time during the day or night when their plant is not used for its regular purposes. Hence, only the electrical apparatus proper might be required, the necessary power being available.

The foundry has practically every melting process under the sun in use for making the various classes of castings. We see the open-hearth, the Bessemer and the cupola, the air furnace and the crucible in operation everywhere. Yet every metallurgist knows that the crucible process gives the best metal, if you can stand the cost. Now, the electrical furnace, if the melting proper is conducted so that the advantages of the crucible process are retained, that is, the temperature not allowed to exceed safe limits, and the metal kept from oxidising influences, is bound to give the highest class of product, and it seems to me with the greatest ease of manipulation.

——o——

PATTERNS FOR PIPE BENDS.

Owing to the varied and comprehensive nature of the work dealt with under the name of pattern-making, this trade has been divided into many grades, but these may be summed up under two distinct sections, viz., engineering and foundry.

Pattern-makers engaged under these respective heads, if given the same work to perform, will, in many instances, adopt entirely different methods. The reason

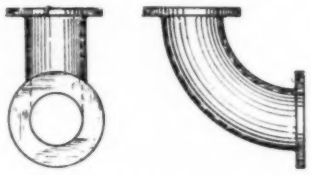


FIG. 1

for this is that each must pursue a course best suited to the circumstances in which he is placed.

The foundry pattern-maker, owing to his proximity to the foundry, has, without doubt, many advantages, and can adopt measures which the pattern-maker in the engineering shop who is engaged in a work where the practice is to procure their castings from an outside maker, finds it impossible to use.

He also has at his command the advice of the foreman moulder when a technical difficulty presents itself affecting that department.

Another disadvantage caused by the isolation of the pattern-shop from the foundry is that it often involves more expensive methods of procedure in both these departments.

It is not always expedient for the engineer to run a foundry, and although this entails certain disadvantages, these are in some respects more than compensated for in the saving from others.

It is the duty, therefore, of every pattern-maker, no matter to what particular branch of the trade he may belong, to see that he adopts the most economical methods of producing his work best suited to the circumstances in which he is placed, and the way by which he carries this into practice forms a means of esti-

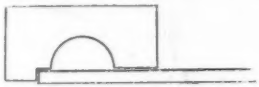


FIG. 3

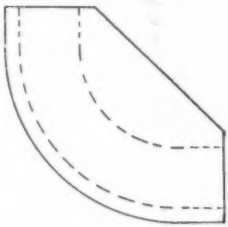


FIG. 2

mating his true value as a tradesman. Within recent years many methods have been introduced into the foundry by which the output of work of a repeating character has been very much accelerated.

These are by no means to be despised, but seldom do we find improvements in the methods for producing work of a special character, of which, perhaps, there is only one casting required.

The method which we propose to discuss in the present article we consider belongs to the latter class, and has special reference to the system adopted by the engineer pattern-maker in dealing with that pattern which forms the title of this article, viz., a pipe bend (see Fig. 1). This is a pattern which clearly illustrates one of these circumstances where a different course of procedure is necessary by the two grades of pattern-makers to which reference has been made, owing to the different conditions in which each of the workmen is placed. The engineer pattern-maker proceeds to build a pattern for a pipe bend in that form known as a solid pattern with core prints at each end to receive the core.

This is a pattern which turns up at frequent intervals, and as it presents no difficulties, an explanation as to its construction is unnecessary.

It is not to the actual pattern, but to the method of dealing with the core, that we wish especially to draw attention.

The arrangement we propose to discuss came under our observation some time ago, and a description of it may be of interest.

We might consider at this stage the method usually adopted by the engineer pattern-maker in dealing with this class of work, and in this way we will be better able to appreciate the advantages to be gained by the adoption of the system already referred to.

One way of dealing with the core for this class of work, and perhaps the most satisfactory, is to make a core-box. This is a very expensive method. Another arrangement, and that which is usually adopted in practice, is to forward with the pattern a template and half-round gauge, as shown by Figs. 2 and 3 respectively.

The moulder's first duty on receiving these is to make two castings from the template, Fig. 2, and on to each of these "run up" a half-core in loam. When

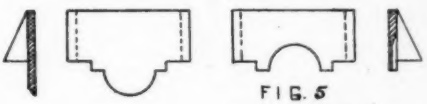


FIG. 5

FIG. 4

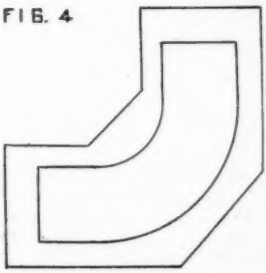


FIG. 6

these are dried they are removed from the plates, tied together with wire, and any discrepancy in the jointing of the halves is filled up with soft loam. It is again placed in the stove, and when dry the core is complete.

The advantage of the method that we wish to describe is that the complete core can be made in one operation, and the loam being superseded for ordinary core sand.

Fig. 6 shows the template, and Figs. 4

and 5 shows the two gauges, which are necessary for this arrangement. The template, Fig. 6, is placed on the top of a hardly rammed floor bed, and the rounded template, Fig. 4, is drawn along

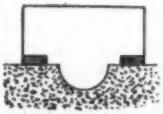


FIG. 7

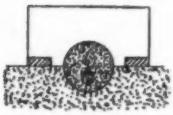


FIG. 8

the curved inner edges as shown on Fig. 7.

When this part of the process is complete, parting sand is freely distributed over it, and this forms, as it were, the bottom part of a core-box.

Now the sand is rammed into this hollow part, and a core iron inserted in the usual manner.

The sand is now built over the bar and is formed into shape by drawing the hollow gauge, Fig. 5, along the same

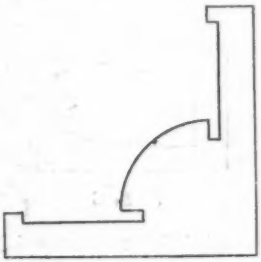


FIG. 9

track as that taken by the rounded gauge, Fig. 4.

Fig. 8 shows a section through the finished core with the hollow gauge in position. The core is now complete, and is removed from the floor by means of the core bar, and placed in the stove to dry, or if a green sand core is suitable for the work, it may be placed directly into the mould.

This method we consider not only makes a better core, but it is more economical, and can be produced in less time, which is a most important factor in some jobs.

In ordinary foundry practice this trouble with the core does not exist.

A duplex, or shell, pattern, that is, a pattern which leaves its own core, would be made by "running up" the pattern in stucco, a description of which appeared in our pages recently.

Another method adopted in foundry practice is to supply the moulder with a template which takes the form of the casting required, as shown by Fig. 9, together with a pattern for the two flanges, and several small pieces of "shell" patterns, which are placed against the template, as shown on Fig. 10. The parts which are

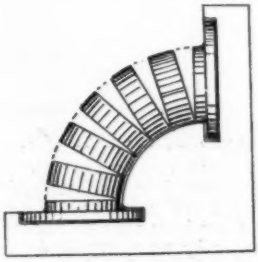


FIG. 10

incomplete are made good by the moulder when finishing the mould.

In this way a very cheap pattern is obtained. When these are correctly set on a laying-down board, the template is removed. The box is then placed in position and rammed up in the usual way.

These small pieces of patterns are part of the pipe founder's stock, and are kept for all the standard sizes of pipes made, and are utilised for the various forms of special castings as the occasion arises.

—o—

A MEETING of creditors of the Amalgamated Brass and Engineering Company, Limited, was recently held before the Birmingham Official Receiver. The liabilities were £6,008, £4,592 being unsecured, while the estimated deficiency was £5,501. The Official Receiver is to act as liquidator.

SAND RAMMERS FOR FOUNDRY WORK.

POWER rammers for use in foundries are comparatively a recent innovation, but from their simple construction and the large amount of work they will accomplish, they are rapidly coming to the front. Owing to their lessening the manual efforts of the moulder they enable him to accomplish from four to five times as much work with greater ease than the ordinary amount of work under the old methods, the increased output being governed by the class of work engaged upon.

Progressive foundrymen will readily appreciate the advantage arising from using a machine of this kind. It is not only the great rapidity with which the work may be done that makes the pneumatic rammer a success, but the fact that the moulds may be rammed much harder than is usually accomplished by hand labour. It is possible to avoid entirely any "straining" in the mould, with a consequent loss of metal and the frequent

FIG. 1.

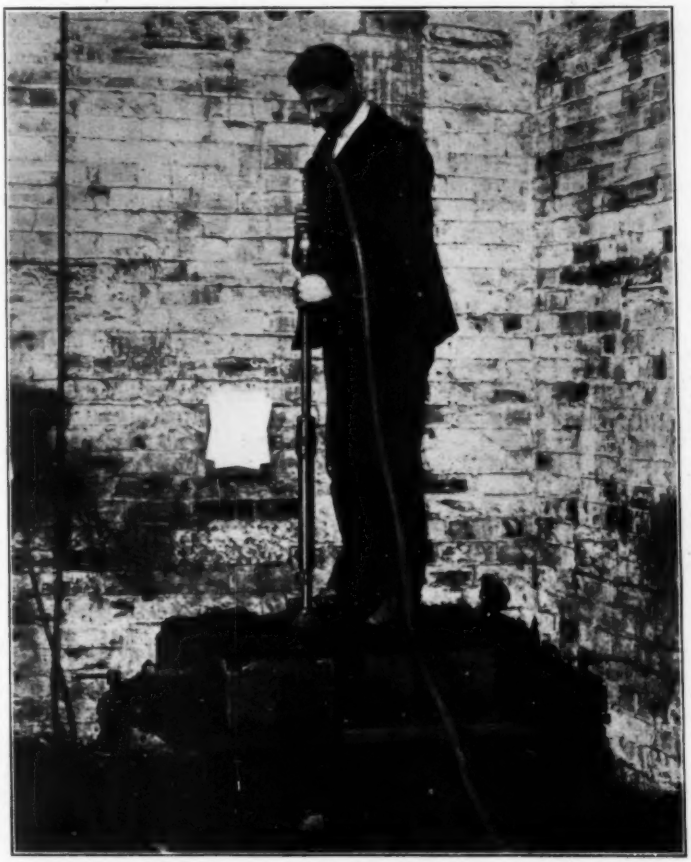


FIG. 2.

rejection of castings on account of "overweight." The latter point will be especially appreciated by steel founders.

The Consolidated Pneumatic Tool Company, Limited, of Palace Chambers, Westminster, are placing on the market a line of rammers which have met with considerable success in foundry work. They make a variety of rammers, and chipping hammers, but one of the principal ones used in foundry work is shown in Fig. 1, and the method of operation is shown in Fig. 2. The throttle is so placed as to give the workman complete control of its operation. The rammer is so proportioned that there is no jar while in operation, the inertia of the moving parts being absorbed by the weight of the machine.

The valve mechanism and piston are enclosed, and all possible care has been taken to keep out dirt. The rammer rods are hexagon in shape, so they cannot turn except at the will of the operator.

These hand rammers are designed to meet a large variety of work in the foundry, not only on the floor, but on the heavier loam work, where they may be used to good advantage alone or as an auxiliary to the heavier type of pneumatic rammer which is suspended from a crane. The hand rammer is, in general design, similar to the suspension rammer, but it is made light enough to prevent its use becoming irksome to the operator.

The firm have also a heavier rammer designed for heavy work where a crane or other overhead support is available. It is especially adapted to heavy loam work, pit ramming, etc. It will do the work of from twelve to fifteen men with old-style hand rammers. The maximum force of the blow delivered by this machine is over 350 lbs., while the average blow from a hand rammer is estimated at 40 lbs.

——o——

THE MIDLAND MANUFACTURING COMPANY, LIMITED, have appointed Mr. H. Chapman, of Preston, as one of their agents.

EXTENSIVE developments have lately been carried out at the Derwent Foundry, Birmingham, of Taylor & Challen, Limited. A new showroom, 80 ft. long, 40 ft. wide, and 25 ft. high, traversed by a 10-ton overhead travelling crane, electrically driven, has just been added, and other improvements contemplated will bring the works up-to-date in every respect.

CORRESPONDENCE.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—The problem set before your readers by "Contractor" is an example of what too often occurs, and all who have the casting of metals in the various forms, will be greatly interested to have this problem thrashed out. It is true that we have, as founders, little to do with design, but how often do we see castings made apparently sound, at some other time present the problem "Contractor" put before us? In such cases we cannot condemn the design. But to get in touch with that law of contraction, which truly is a *cast-iron law*, namely, to cool a casting equally, is to be in sympathy with such law and the only way to avoid such disasters as the case in point. The fact that next morning the boss was warmer than the rim proves that this law was not complied with, and which at an earlier stage must have been much more pronounced. If the casting was run on the boss, "which is a likely place," and the core *not* removed, it would retain its heat longer than the rim which was bared. Another point we overlook often, is that the outside of castings are often close to the moulding box, which is a greater conductor of heat than the sand that covers the centre of castings, and to counteract this is a point that must not be forgotten. In this case it may have contributed to this disaster, during the hour and a half that the rim was covered. I have often seen lighter castings, "when run inside," break or warp badly, but when the runners are cut outside, are sound and in perfect shape. I believe in looking out on these lines we shall avoid some of these troubles.

Yours faithfully,
ARTHUR BOWMAN.

New Road,
Burnham-on-Crouch.

GAS IN TAPPING METAL.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—I should be greatly obliged if you could give me any answer to the following query:—When tapping iron from the furnace if you allow the slag to follow until the metal in the ladle becomes covered, I have noticed quantities of gas

bubble through the slag and burn on top with a whitish flame. The flux used was chalk. Can any reader tell me what gas this is and if it is generated by the slag or the iron?

Yours, etc.,

W. HUGHES.

Bishop's Stortford.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—In the February issue of the above journal, you print an abstract of my paper, "The Characteristics of Foundry Irons," read before the British Foundrymen's Association. In dealing with causes of defects, you print the following:—"The use of unsuitable coal or coke and the bad pouring of the metal." This should read as follows:—"The unsuitability of the metal and bad design of the pattern, allowing undue cooling strains, being the cause also of defective castings." Will you please rectify this error in your next issue.

Yours, etc.,

GEORGE HAILSTONE.

217B, Great Colmore Street,
Birmingham.

MESSRS. CAMM, BAGSHAW & COMPANY, Queen's Road Works, Sheffield, have appointed Messrs. L. H. Lucy & Company, Botolph House, 10, Eastcheap, London, E.C., as their London agents for the export trade.

ROTARY BLOWERS: THEIR CONSTRUCTION, EFFICIENCY AND APPLICATION.—II.

BY GEORGE C. HICKS, JUN.

Type of Machines.

TAKING up the different styles of building rotary exhausters and blowers, we find two general classes, the vertical and horizontal types, which may be subdivided into single- and double-geared machines. For pressures up to 1.5 lbs. and comparatively low speeds, the vertical machine has equal utility with the horizontal type and has the advantage of lending itself readily to piping arrangements, including the by-pass. The horizontal machine is stiffer and can be run

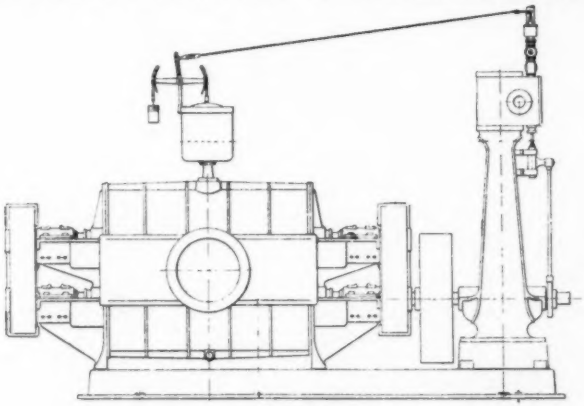


FIG. 1.

at from 25 to 40 per cent. higher speed than the vertical machine, without undue vibration. The gear reactions form a limiting condition for speed in a vertical type.

Now as to machines geared at both ends, or only at the driving end. In favour of double gears, there are these points. More uniform wear on back and front bearing, less chance of accident from getting all the pressure on the end of one tooth, better opportunity for caring for back lash and in case of a tooth breaking, ability to operate the machine with the gears at the opposite end. Objections: two additional moving parts to care for and oil, chance of throwing all the work on one pair of gears and of transmitting unnecessary strains through the driving shaft to the back gears. In

favour of single gears, less complication, the concentration of all the wear at one point proportioned to take care of it. Objections : chance of crippling the machine entirely if a tooth in either gear should break and the tendency to wear front bearings more than the back ones, thus throwing the machine slightly out of line. Both styles have proved serviceable and durable for all classes of work, and the choice should be made on specific arrangements, such as driving arrangements, space, etc. For low pressures, either type; for high pressures (say 2 lbs. and over), I prefer single gears with double outboard bearings. These outboard bearings stiffen the machine and divide the load of the gears on to two bearings, which makes it much easier to keep the shafts in accurate alignment. The double-gear arrangement, however, has been longest on the market and experience has proved its utility, but as the tendency is towards higher speeds and pressure, it is my conviction that the stiffness afforded by the single-geared machine with double outboard bearings is the better arrangement for such service. If it were only equally good, it would be better on account of its simplicity.

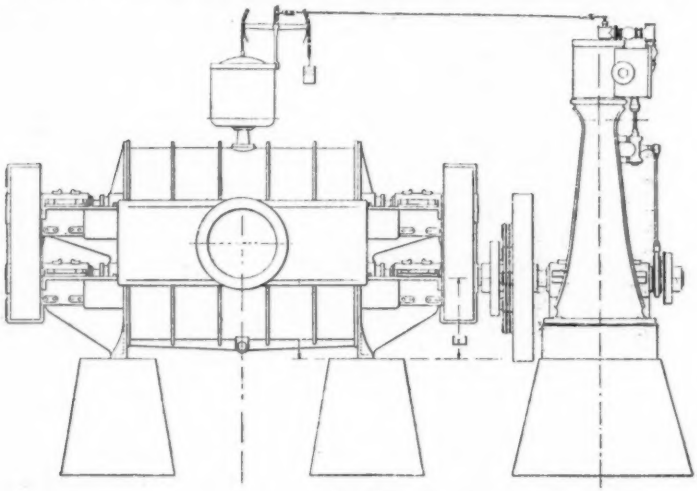


FIG. 2.

Method of Driving.

The various methods of driving may be divided into three classes, belt or rope, pinion and gear, including the silent chains and direct connection, either rigid or flexible coupling. The belt or rope may be dismissed with few words, as the losses inherent in belt transmission are well known and should not run over 3 per cent. of the power transmitted and probably not under 2 per cent. Keep the speed of the belt preferably between 3,000 and 4,000 ft. per minute, the belt pull from 60 to 80 lbs. for double belt per inch of width. For light drives, an overhung pulley is permissible. For 1.5 lbs. and up, use an outboard bearing. An outboard bearing is never amiss under any conditions of load, as it relieves the machine of strains which tend to wear the bearings and allow the impellers to get out of position. The same precautions apply to the silent chain drives and to the gear and pinion. Use outboard bearings for 1.5 lbs. and up and always consider them a good investment. The silent chain makers claim an efficiency of 98 and 99 per cent. Gear transmission runs from 90 to 95 per cent., according to the speed reduction and condition of the gear. Gears and silent chains are mostly used for motor drives, although gas-engine speeds are such as to frequently require speed reducing transmission. Hydraulic turbines may be geared or direct connected. Steam turbines have never yet been applied, as far

as I know, to the rotary blower, the objection being the great change in speed necessary. However, I believe this objection could be overcome by the use of high-speed helical gears such as are used on the De Laval turbine. The larger percentage of blowers and exhausters are direct connected when driven by engines. The line cuts presented herewith show the general methods in use. Fig. 1 shows a rigid coupling, side or centre crank engine, the flywheel forming one-half the coupling. A centre crank engine is best here, as it relieves the exhauster bearing of the crank thrust. This style is well suited to small machines and light loads. Fig. 2 shows a centre crank engine with flexible coupling, no outboard bearing and gives no engine load on the exhauster or blower. It is a good construction for light or heavy loads and for engine sizes as large as an overhung flywheel is desirable. Fig. 3 is a horizontal side crank engine with outboard bearing and flexible coupling. This is, in my opinion, the best method of any of the others. Each machine is self-contained, and, therefore, each machine may be adjusted for wear or misalignment without reference to the other. All rigid connected machines are more or less dependent one on the other. Few engines have vertical adjustments, and all rotary machines must be adjusted vertically at times. The heating of an engine shaft tends to thrust the impellers against the back head plate, while wear tends to pull the impellers against the front head plate. Also, flywheels have a tendency to assume a different position when running than idle, and this fact sometimes necessitates a readjustment of the rigid coupling Fig. 4 represents a single-geared, double outboard bearing machine, and may be used with either centre or side crank engine. In rigid connected outfits, the double outboard bearing may be used as the outboard bearing of the engine and the half coupling placed on the driving gear, or the engine may have its own outboard bearing and the coupling placed between the two outboard bearings of the respective machines. A flexible coupling can be used between the two outboard bearings with a side crank engine, but if used with a centre crank engine the outboard bearing may be dispensed with. Bed plates should always be used under rigid connections; at least under the adjacent parts leading to the coupling. It is a very difficult matter to maintain rigid connections when the engine and blower or exhauster are on a separate foundation and without a bed plate.

Construction of High-Pressure Machines.

With the increased demand for machines operating under pressures of 4 lbs. and over has come a closer study into the most efficient and durable design for this class of work. In order that close fits with small clearances may be used, the construction must be such as to secure great rigidity. This is best done by shortening the machine, thus reducing the length of the greatest leak opening, the contact between the impellers and also reducing the work of the gears, provided the same width of face is used. The question may be asked : Why not use smaller gears with wider face? It is not good practice, however, to use too wide a face on a gear, as it is almost impossible to secure uniform contact with the whole-tooth surface in wide-face gears. It is better to put more money into a machine with larger gears than into a machine of equivalent displacement, but of greater length and smaller gears, for it is much harder to maintain the same efficiency with a smaller machine, as the clearances must be made closer and the chances of trouble much increased.

Double outboard bearings should be

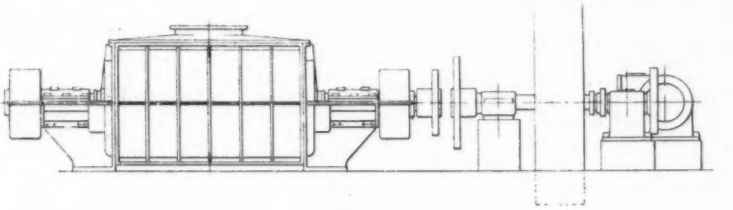


FIG. 3.

part of all high-pressure specifications. I should say, roughly, that for air for pressures from 3 to 6 lbs. use a case length not over 2.25 gear diameter and a bore not over 1.65 gear diameters. The same machine for gas up to 4 lbs. For 6 to 10 lbs. of air, use 1.25 to 1.5 gear diameters, and for gas use the same machine from pressure of 4 to 8 lbs. Some variations either way are allowable, but I am stating safe limits that have been proved by actual practice.

We cannot always build according to our best design, for the commercial side is standing with uplifted club to knock in the head any attempt that means perfection. We must of necessity be a little short of our ideals; but always pushing the standard ahead and creeping forward with so slow a movement that the uplifted club never falls.

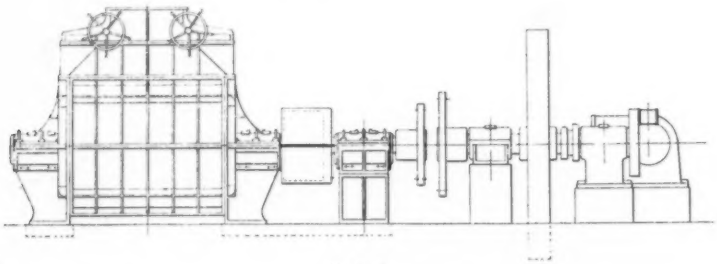


FIG. 4.

Methods of Testing.

There are three simple methods of testing rotary blowers, as follows: First, the closed discharge method; second, the stationary method; and, third, the standard orifice method. There is still another method, which necessitates greater care and more apparatus, and that is the use of the Pitot tube, and, of course, actual meter or tank measurements. I shall explain the first three only, as the other methods are familiar to all of you.

The closed discharge method is to operate the machine at such speeds that the displacement is just equal to the slip. This is done by closing the discharge and rotating the machine at such speed as will just maintain the desired test pressure. This method is based on the theory that the slip is a constant quantity per minute, independent of the speed. This is not strictly true, as an investigation of the test data will show that the efficiency increases faster than the speed ratio. There is undoubtedly a point where the two curves cross, and this point is near the normal operating speed of the machine, for there have been numerous checks to confirm this statement. For high-speed machines I believe the closed discharge method gives results too low.

The stationary method is to block the machine and pass air or gas back through it, the air or gas being measured by displacement of water either before or after passing through the machine.

Third, the standard orifice method is, in my opinion, the easiest to use, and the most accurate, for after the standard orifice is once calibrated, a curve of flow for different pressures may be plotted. Any number of these orifices may be used with the precaution of spacing them equally around the central axis of a chamber that is also uniform about the same axis. They should, of course, be placed in a plane at right angles to this axis.

——o——

MR. H. GIELGUD, London representative of the Angleur Steel Works, Limited, has removed to 7A, Laurence Pountney Hill, Cannon Street, E.C.

THE WALLACE STEEL WORKS, SHEFFIELD, will, in future, be carried on under the style of A. Blyde & Company, owing to dissolution of partnership.

WILLIAM COOKE & COMPANY, LIMITED, of Tinsley, Sheffield, have made an issue of 28,000 5 per cent. cumulative preference shares of £11 each at par.

THE BIRTLEY IRON COMPANY, LIMITED, Birtley, R.S.O., Durham, are supplying 3,000 yards of cast iron faucet and spigot water mains to the Blyth Urban District Council at £5 5s. per ton.

LIGHT ALUMINIUM ALLOYS.*

By J. E. Stacey Jones, B.Sc.

The production of aluminium in Great Britain is a monopoly controlled wholly by the British Aluminium Company. A great quantity of metal now comes into the market from the Continental works. This has been produced by the same, or similar, processes as Héroult's, and it is probably only the influx in the last 12 months or so of this foreign aluminium that has kept the price where is is, about £200 per ton for pure metal, or 1s. 9½d. per lb.

Up to that time—about the beginning of the spring of this year (1906)—very little was imported, owing very probably to mutual agreements between the companies, and the lack of competition caused the market price to continually increase from £130 in July-August, 1905, to £200, a rise to the present price from 1s. 2d. per lb.

No doubt as the importing of aluminium increases from greater Continental production, and on the lapse in a short time of the British Aluminium Company's patent rights, the price will tend to fall again. These patents of Héroult's become void in 1908; probably the fall in price will not be very great or rapid at first, as fresh uses are continually being found for the metal, with consequent continually increasing demand.

At the present time a new company is being floated, to undertake the manufacture of aluminium by the same process as just described; the proposed new works are to be built at Kinlochleven, on the borders of Argyllshire and Inverness-shire, and are to be driven by water power, the same as the works at Foyers.

The British Aluminium Company have also decided quite recently to acquire water power, and build aluminium works in Norway. Their idea is that, as the Foyers falls do not give sufficient water in the Scottish summer to drive at full power. The aluminium production will then be transferred to Norway, where there is then plenty of water. *Vice versâ*, when the Norwegian watercourses are frozen in the winter, the falls of Foyers will be in full swing.

Thus they hope to keep the staff required to the minimum, and to be able to keep pace with the demand.

* Paper read before the Coventry Engineering Society.

Properties of the Pure Commercial Metal.

Commercially "pure" aluminium contains at present on an average 98½ to 99½ per cent. of the metal, with small amounts of iron and silicon, and sometimes zinc.

A few years ago this purity was not attained, over 2 per cent. of iron and silicon being found in the best metal. It was found that the impurity of the alumina and the carbon anodes used was the cause of this, and now the British Aluminium Company have improved their extraction processes at Larne, and built their own carbon works at Greenock. All the other companies have also their own ore mines, extraction plants, and anode works.

The iron that pure aluminium contains in commerce is derived from both the alumina and the electrodes, and the silicon chiefly from the alumina. Nitrogen is also present, probably as aluminium nitride; it slightly reduces the breaking strain, elongation and elastic limit. This nitrogen is identified by its evolution as ammonia if the metal be dissolved in caustic soda.

Carbon is nearly always present, but in very small and usually negligible amount. This element has a much more marked effect than the nitrogen in reducing the elongation and tensile strength, but is not usually present in sufficient quantity to cause much loss of strength.

The white colour of aluminium (which depends somewhat on the casting temperature), its freedom from oxidation, great lightness, and comparative strength therewith, combine to give it a character distinguishing it from all other metals.

It is certainly true that under ordinary conditions the metal, especially when pure, is not oxidisable at ordinary temperatures and only very slightly at extremely high ones. But an interesting experiment, which can be performed by anyone, shows that its resistance to oxidation is easily upset, in the presence of mercury, for example.

A piece of aluminium, plate, sheet, wire, or solid ingot, is wetted with some fairly strong hydrochloric acid, about equal parts of acid and water, and then a tiny globule of mercury put on and rubbed well in. The mercury will adhere to the aluminium after a little rubbing, forming a bright amalgamated surface; if now the metal be rinsed in water and wiped dry, after a very short time beauti-

ful feathery, white crystals of alumina will start to grow on the surface. After about half an hour, these will have grown so long that they will fall over in a curve from the top. The cause of this is no doubt the fact that the particles of aluminium alloyed with the mercury are in a much finer state of division than ordinarily, and hence are more susceptible to oxidation by the air. The energy of the oxidation is sufficient to heat the metal considerably.

The tensile strength of cast aluminium is not very high (for the pure metal), being only about 6 to 7 tons per square inch for good samples, and it is also very brittle. The following table gives figures obtained for castings and mechanically-worked metal:—

TABLE I.—*Limits of Strength for* 99—99.5 *per cent. Aluminium.*

—	Tensile strength	Contraction of area.
	Tons per sq. in.	Per cent.
Castings	6.3— 8	About 15
Sheet	12 —18	,, 20—30
Wire	11 —24	,, 40—60
Bars	12 —28	,, 30—40

The specific gravity (or comparative weight against an equal volume of water) varies from about 2.6 when cast to 2.7 when rolled, and it is this low value which makes aluminium so eminently suitable for work such as motor car parts, where a fair degree of strength is necessary, and must be combined with low weight.

Pure aluminium is occasionally (or perhaps, one might say, for the last few months, often) met with in what is known to foundrymen as a "burnt" condition. I intend to deal with this a little later, but may remark that if the metal comes into the foundry already spoiled, no amount of faking can restore it, as far as is known at present.

This rotten metal is rather difficult to prove to be bad; the most positive test is the determination of its ultimate tensile strength. Recently some particularly bad stuff has been through my hands for testing and report, with the results shown in Table II. (columns A and B).

To see the effect of "burning" the pure metal, I actually performed the experiment of allowing a quantity of undoubtedly good metal to remain for about two hours in the furnace, and thus become "burnt"; test pieces were made before and after, and the results show in a marked degree the reduction in strength that takes place. In Table II. above, columns C and D, the strength at first being 6.1 tons, becomes 3.1 tons after spoiling.

TABLE II.

—	"Burnt" metal.		Effect of "burning."	
	Pure.	90% alloy made from pure in A.	Good pure metal.	
			Before.	After.
	A	B	C	D
Tensile strength: tons per sq. in....	4.6	5.4	6.1	3.1
Elongation on 2 in. per cent.	7	2.5	—	—
Contraction (p.ct.)	7	5	—	—
Aluminium, p.cent.	98.6			
Copper	nil			
Zinc per cent. ...	0.3			
Silicon ,, ...	0.4			
Iron ,, ...	0.7			

Light Alloys.

Aluminium is not used for technical work, as in motor car construction, in a pure state, as its strength is not sufficiently great.

The light alloys, in contradistinction to aluminium brasses and bronzes, etc., may be divided into two broad classes for convenience:—

1st. Alloys of aluminium, copper, and zinc, in various proportions; this class forms by far the most important series of mixtures. I should think that fully 90 per cent. of aluminium alloys at present used come within this category.

2nd. Alloys (special) of aluminium with such metals as tungsten, nickel, manganese, silicon, antimony, titanium, chromium, and silver, with or without either or both copper and zinc.

These special alloys have no end to their peculiarities; those of tungsten and magnesium are fairly well known, and in constant use for many purposes. Some of the others have been introduced with a great flourish of trumpets, and have early died a natural death. The great strength and other marvellous properties given to them by the fancy and imagination of the maker or patentee has not always "panned out" in practice.

In Coventry we are really only concerned with the cast metal, and in ordinary sand castings it is very difficult to get a strength of over 12 tons per square inch, even with special mixtures,

unless lightness or cheapness are sacrificed.

Copper-zinc Alloys.—In these pure and simple, the British Aluminium Company's No. 6 alloy is perhaps the most widely known. I believe that this metal is supposed to be somewhere about 85 per cent. of pure aluminium, but the figures in Table III. will show that we get sometimes serious variations in the amounts of zinc present. The copper seems to be fairly constant at about 2.6 per cent.

TABLE III.—*Variation in Composition of B. A. Co.'s No. 6 Alloy.*

—	A	B	C	D
	Per cent.	Per cent.	Per cent.	Per cent.
Aluminium	96.2	90.5	87.7	94.4
Copper ...	2.7	2.4	2.8	2.5
Zinc ...	0.8	6.0	8.9	2.7
	2 ingots of same consignment analysed together		S.G. 2.96	

As a general rule it may be taken that an increase in the zinc and copper content means also an increase in the strength—in castings, of course. But, as I have mentioned before, ordinary sand castings are difficult to get to more than 12 tons tensile strength, unless they are water-chilled. If cast in metal moulds their strength is also increased.

Special Alloys.—Wolframinium: The specific gravity of this is given as 2.75, and it is supposed to contain, besides tungsten, small quantities of tin and antimony. Columns A and B in the following Table IV. show a published analysis and one done by myself on this alloy.

Romanium.—See Table IV., column C. When rolled the metal is about as strong as wolframinium, but harder and more elastic.

In *tungsten alloys* generally it has been found that a fraction of 1 per cent. of this element makes metal for tubes, sheet, strip, etc., much stronger, and increases the resistance to corrosion. It also renders the alloy able to be spun, drawn, or rolled well, and antimony gives good casting properties. Such alloys as wolframinium, romanium, and the British Aluminium Company's "No. 4" are used extensively for cycle rims, such as, for instance, the well-known "Roman rims."

No. 4 alloy gives the following results when rolled for cycle rims, from my own results. The specific gravity is about 2.75. Samples that were fit for use and otherwise are compared. (See Table IV., columns D, E, F, G.)

Aluminium rims suffer from the disadvantage of being subject to corrosion, especially in a marine atmosphere. In some experiments done a year or two ago to discover the reason of this, we found

TABLE IV.—*Composition and Strength of various Aluminium Alloys.*

—	A.	B.	C.	D.	E.	F.	G.	H.	J.	K.
	Wolframinium.		Romanium.	B.A.Co., No. 4 alloy (hard rolled for rims).				Partinium.		
—	Published analysis Dec., 1905.	Analysed Nov., 1905.	Published analysis Dec., 1905.	Good samples.		Bad samples.		Published Dec., 1905.	Analysed 1906.	"Magnalium" rolled for cycle rims.
	Per cent.	Per cent.	Per cent.		Per cent.	Per cent.		Per cent.	Per cent.	Per cent.
Aluminium	93.0	99.4	97.0	—	95.5	96.3	—	96.0	91.0	94.5
Copper...	0.4	nil	0.3	—	4.0	3.0	—	0.6	6.0	2.0
Zinc	—	nil	nil	—	nil	—	—	—	2.3	2.0
Tungsten	0.04	0.1	0.17	—	0.1	0.4	—	0.8	trace	—
Tin	0.1	nil	0.2	—	—	—	—	0.2	nil	—
Antimony	1.4	nil	0.3	—	—	—	—	2.4	nil	—
Nickel	—	—	1.8	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	Brittle	—	—	1.0
Magnesium	—	—	—	—	—	—		—	—	0.6
Tensile strength (tons per sq. in.)	13 hard rolled		23.8H.R.	14.5	16.8	9.6	9.1	—	—	9.3
	17 annealed		17.1A.							
	10 castings		—	—	—	—	—	—	—	—
Elongation per cent.	2 hard rolled		5.0H.R.	19.0	22.0	22.0	17.0	—	—	25.0
	15 annealed		19.0A.							
Contraction per cent.	—	—	—	29.0	34.0	32.0	29.0	—	—	26.0

that the fabric of the tyre was at fault, and not the metal. The chemical substances, either natural to the fabric or used in its manufacture, were proved to be wholly the cause of the corrosion, and apparently all tyres were alike in this respect.

The experiments were done with the object of artificially corroding the rims with tyre sections, and the rotting effect we found greatest in a warm, damp atmosphere. Probably the greater amount of chemical action taking place in the vicinity of the sea might be ascribed to the ozone and hydrogen peroxide present in the air there, and occurring in greater amounts than in inland districts.

To resume consideration of the special alloys of aluminium, *partinium* is put on the market by a French Company, and columns H and J in Table IV. give the composition as published and found by me.

FIG. V.—*Effect of Magnesium in Lowering Sp. Gr.*

—	Sp. gr. 2.78.	Sp. gr. 2.78.
	Per cent.	Per cent.
Aluminium	90	84.5
Copper	3	3
Zinc	7	9.5
Magnesium	—	3

"*Magnalium.*"—Alloys under this appellation are made from mixtures of copper, zinc, and magnesium, and they are remarkable from two causes. The first is that they are lighter than aluminium, at least if the magnesium is present in anything like quantity; and the second, that their strength is superior also.

The lightness arises from the fact that the specific gravity of magnesium is only 1.7, while pure aluminium is 2.6. Magnesium is the only metal that is lighter than aluminium, and at the same time suitable for alloying with it. All the other lighter metals or metalloids, such as sodium, potassium, calcium, sulphur, phosphorus, etc., are either prohibitive in price or properties.

To show the effect of adding a small percentage of magnesium to an aluminium alloy, Fig. V. may be noted. Both the metals of which the final composition is given would have the same specific gravity, namely, 2.78, but the addition of 3 per cent. of magnesium enables more zinc to be put in without pulling up the weight. Of course, the addition of even this small amount of magnesium would increase the price about 4d. per lb.

"Magnalium" alloys, then, are mixtures of ordinary aluminium copper-zinc alloys with magnesium, and the name is the property of the Magnalium-Gesellschaft, of Berlin. Castings can be made in chills, or in sand and water-chilled, having a tensile strength of anything up to 27 tons per square inch, according to the amount of magnesium present.

The amount found most suitable to give the best results seems to be about 10 to 15 per cent. magnesium, giving an alloy which melts at about 700 degrees C.

The following diagram, compiled from an article by Dr. J. W. Richards before the American Society for Testing Materials, in 1903, shows very clearly the rise in strength with the content of magnesium in sand or chilled castings:—

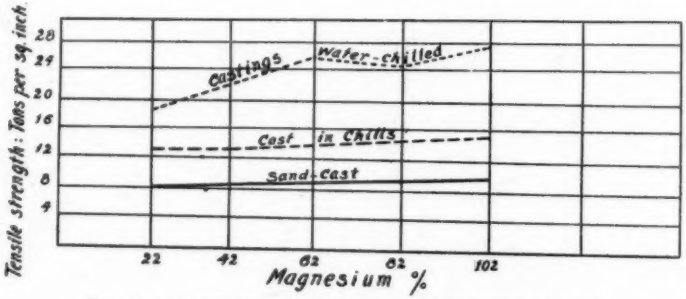


FIG. 1.—STRENGTH OF MAGNESIUM-ALUMINIUM ALLOYS.

A sample of rolled magnalium submitted for use for cycle rims, and containing about 0.6 per cent. magnesium, had the

composition and properties as given in column K, Table IV.

Fig. 2 gives recent results that I have myself obtained with alloys containing silicon and manganese. These elements, used in certain proportions, seem very promising; the silicon alloys have the advantage that the addition of this non-metallic element will not increase the weight unduly, the specific gravity of silicon being practically the same as aluminium. The curve shows that addition of silicon up to 1 per cent. is beneficial, higher amounts making the metal weak and brittle.

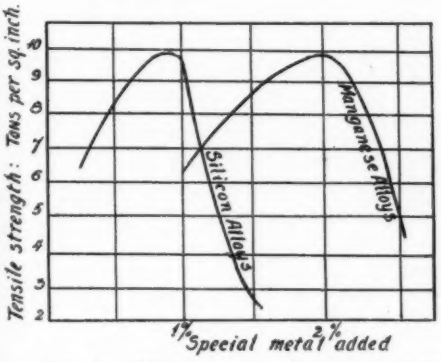


FIG. 2.—STRENGTH OF ALLOYS OF ALUMINIUM WITH SILICON AND MANGANESE.

Manganese up to 2 per cent. is more promising, and I propose in the near future to experiment further in this metal. Alloys with from 1 to 8 per cent. have been found by other observers to give good results for rolling into sheets.

(*To be continued.*)

—o—

THE Home Office has issued an order extending the Notice of Accidents Act, 1906, to the following classes of occurrences in a factory or workshop, whether personal injury or disablement is caused or not:—"All cases of bursting of a revolving vessel, wheel, emery wheel, or grindstone moved by mechanical power; breaking of a rope, chain, or other appliance used in raising or lowering persons or goods by aid of mechanical power; fire affecting any room in which persons are employed and causing complete suspension of ordinary work therein for not less than 24 hours."

THE VICISSITUDES OF THE BESSEMER PROCESS OF STEEL-MAKING.

AT a meeting held under the auspices of the British Foundrymen's Association at the Municipal Schools of Technology, Manchester, on March 2, 1907, a highly interesting and instructive paper was contributed by Professor Carpenter, Ph.D., F.R.S., entitled,

"The Vicissitudes of the Bessemer Process of Steel-making."

The author, whose paper took the form of an abridged autobiography of the life of Bessemer during the earlier stages of his career as an inventor, gave a graphical account of the formidable difficulties and obstacles with which the great revolutioniser was confronted in arriving at the results which he hoped would perfect his process, and also in introducing the product into the commercial world for universal use. The actual methods employed in the Bessemer process were explained at some length, and special reference was made to the apparatus used by Bessemer in his experiments, as compared with that in use at the present day—the Professor illustrating his remarks with a series of specially prepared lantern slides.

At the close of the paper several questions were put to the author which gave rise to a keen discussion amongst the members, reference being made to the relationship which is claimed to have existed between Bessemer and Muslett in business.

All queries having been settled, and a series of remarks having been made by the President, Mr. Sherburn, and Mr. W. Bransby, a vote of thanks was proposed to Professor Carpenter for his paper, which was duly seconded and carried. At the close of the meeting the Committee expressed its gratification at the steady increase in membership, and it was remarked that before very long the Association might hope to approach that standard of efficiency attained by the American body, which had done so much good in elevating the iron and steel industries of that country.

—o—

MR. H. W. WALLACE, engineer, has removed from London Road, Croydon, to the Wellesley Engineering Works, Wellesley Road, Croydon.

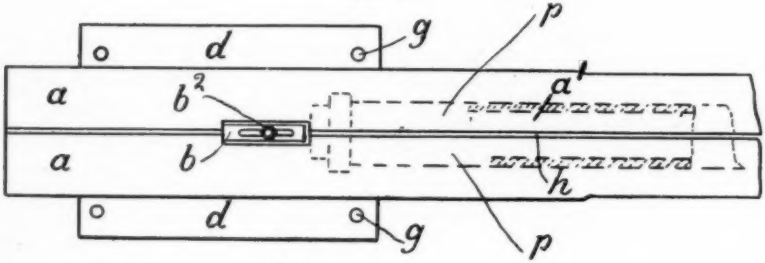
LIST OF NEW INVENTIONS.

Specially compiled for THE FOUNDRY TRADE JOURNAL by MR. GEORGE BARKER, Fellow of the Chartered Institute of Patent Agents, Consulting Engineer and Chartered Patent Agent, 77, Colmore Row, BIRMINGHAM.

1906.

8,961. JOHN HALL & SON, LIMITED, Union Iron Works, Oldham, Lancs. Improvements in the method of and means used in connection with the moulding of metal pillars, columns, and the like.

FIG. 1.



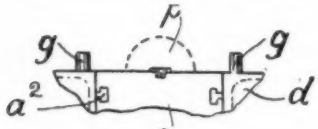


FIG. 2.

This invention relates to the moulding of cast-iron pillars, columns, supports, and the like, used for buildings and elsewhere.

According to this invention the mould is made from a half-pattern arranged on a plate upon which the casting boxes can be placed, the sand being rammed with each box in position upon such plate so as to produce two half-points, the first box, when removed, being inverted, and the second laid on the first and in correct register therewith.

In Figure 1 is shown a portion of a plan of a suitable foundation plate upon which half-patterns can be held and the moulding boxes prepared, and Figure 2 shows an end view.

The upper surface of the foundation plate a is accurately planed and formed with a central groove a^1. This serves as a guide for the brackets b, each of which has a slot b^1 which engage a^1. Each bracket is adjustable, and is fixed by a stud b^2 engaging one or other of a series of holes in a. The groove a also serves to receive keys c or similar interlocking means several of which are fixed on the back of the half-pattern p as shown at Figure 2. The keys c serve to prevent lateral displacement whilst the brackets b prevent endwise movement. Brackets d are used for accommodating any large sized portions at the ends of the pillars. The slots a^2 serve to clamp the plate d in place by means of T plates. In making the mould the half-patterns are secured as shown at Figure 2, and the first half-box is then brought over it and the sand rammed firm, the half-box being held in position by pins g. This gives the half-joint, and the process is repeated with the other box. The two moulds are then brought together and suitably adjusted so as to register correctly.

Any known method of "coreing" may be used.

1907.

3,208. T. HURDLEY and T. C. HURDLEY, 46, Lincoln's Inn Fields, London. Improvements in or relating to the manufacture of malleable metal articles and means employed in such manufacture.

2,153. MARIUS ABEL HUGHON, trading as Hughon & Company, 18, Southampton Buildings, Lon-

don. Improvements in and relating to apparatus for bending tubes.

2,190. T. Downie and D. Brown, 15, Water Street, Liverpool. Improvements in or connected with furnace fronts and doors.

2,317. H. B. Stocks, 5, Dalton Street, Manchester. Improved portable air compressor.

2,561. B. Talbot, 55, Chancery Lane. Improvements connected with ports for open hearth, melting, or like furnaces.

1,904. Josef Vorraber, 68, Alterwall, Hamburg, Germany. Improvements in moulding presses.

3,569. E. Wheeler, 4, Fairfield Terrace, Higher Openshaw, Manchester. Apparatus for the heating of the air blast supplied to cupolas and other furnaces.

3,681. Oscar Bender, 7, Southampton Buildings. Improvements relating to nozzles for supplying liquid or gaseous fuel to furnaces.

—o—

TRADE TALK.

Operations at the new Diamond Foundry, Luton, are now in full swing.

Messrs. Lees & Taylor, Millbank Engineering Works, Hartlepool, are retiring from business.

The Hercules Engineering Company, Limited, Crown Buildings, Doncaster, is in course of being wound up.

The Klein Engineering Company, Manchester, have removed their London offices to 51, Moorgate Street, E.C.

Kramos, Limited, Locksbrook Engineering Works, Bath, have established offices at 47, Victoria Street, Westminster, London, S.W.

New engineering works are to be established at Albert Hill, Darlington, by Mr. J. Tinsley, Perseverance Works, Stalybridge.

The Pallion Forge and Engineering Company, Limited, are carrying out extensive alterations to their works at Sunderland.

An 150-ton cantilever crane has been erected on the river front of Messrs. Armstrong, Whitworth & Company's Elswick shipyard.

Mr. F. G. Guillet, 58, Holborn Viaduct, E.C., has been appointed London representative of Willetts Adshead, Limited, Falcon Works, Dudley.

Messrs. Henry Pels & Company, Danes Inn House, 265, Strand, London, W.C., have established premises in Paris.

The National Radiator Company, Limited, Hull, have acquired the business of the American Radiator Company, 90, Shoe Lane, London, E.C.

A proposal is under consideration for amalgamating the Birmingham Small Arms Company and the Eadie Manufacturing Company, of Redditch.

Messrs. Frampton & Paine, 29, Old Queen Street, S.W., have been appointed London agents for Messrs. Morris & Lister, Carlton Works, Coventry.

Messrs. E. Vernon and A. Richards, engineers, Smethwick, Staffordshire, trading under the style of Vernon & Guest, have dissolved partnership.

Messrs. Edwin Danks & Company, Oldbury, have appointed Mr. H. Perkins, 9, Adelaide Street, Swansea, as their sole agent in South Wales and Monmouthshire.

Messrs. J. G. Chamberlain and R. Player, engineers, etc., Tipton, Staffordshire, trading under the style of Joseph Wright & Company, have dissolved partnership.

The American Foundrymen's Association will hold their next convention in Philadelphia, from May 21 to 24, by invitation of the Philadelphia Foundrymen's Association.

A. & J. Main & Company, Limited, Clydesdale Iron Works, Possil Park, Glasgow, have supplied most of the structural ironwork for the new extensions of the Burma Railways.

Mr. A. R. Walmsley has acquired the engineering business of Peacock, Cliffe & Company, Limited, Cornbrook Park Road, Manchester, and will trade under the style of A. R. Walmsley & Company.

The Union Drawing Office and Print Company, 175, St. Vincent Street, Glasgow, have lately placed on the market a new drawing pen, for which they claim improved quality of lines drawn in reduced time.

The Church Iron Works, Ince, have been acquired by Mr. J. Wood, of J. Wood & Sons, Limited, engineers, Wigan, who will continue the business under the

style of the Church Iron Works Company.

MESSRS. PILLEY & COMPANY, Eldon Street House, London, E.C., have been appointed agents for London and the South of England for the Railway and General Engineering Company, Limited, Nottingham.

MESSRS. J. L. THOMPSON & SONS, North Sands Shipbuilding Yard and Manor Quay Engine Works, Sunderland, have decided to establish an engine and ship-repairing yard in close proximity to their present works.

THE creditors of the Manchester and Milford Engineering Company, Limited, are required to send their claims to Mr. F. Poole, 22, Conduit Place, Spring Street, Paddington, London, the liquidator, before March 11.

MESSRS. CROSIER, STEPHENS & COMPANY, 2, Collingwood Street, Newcastle-on-Tyne, are the sole agents for the Tyne and North-East Coast for the sale of a pneumatic hammer placed on the market by the Climax Patents, Limited.

MESSRS. DRUMMOND BROTHERS, Guildford, have under consideration large extensions to their works, including a new pattern shop, 80 ft. by 48 ft. Plans have also been passed for new workshops possessing double the capacity of the present premises, the plant for which is already under order.

A COMBINED weighbridge, which has been designed to weigh a single load of 30 tons upon either weighbridge, or a combined load of 60 tons upon the two, has been despatched for use on the Mashonaland Railway, by W. & T. Avery, Limited, of the Soho Foundry, Birmingham.

THE FALKIRK IRON COMPANY have recently completed at their works at Falkirk, a large despatch warehouse, measuring 300 ft. long by 100 ft. wide, with four lines of rails and two island platforms 300 ft. long by 27 ft. wide each. Accommodation is provided for over 50 wagons. This addition to the despatch department will afford greatly increased facilities for the rapid despatch of goods and prompt execution of orders, enabling the Company to send away 50 wagons daily, and by working double shifts, 100 wagons, besides which the storing accommodation is again considerably added to. At their London warehouse the Company have recently completed improved and extended show rooms.

NEW COMPANIES.

WILLIAM TUDHOPE & SON, LIMITED.—Capital £20,000, to acquire the Crown Iron Works, Coatbridge.

H. W. KEARNS & COMPANY, LIMITED.—Capital £50,000, to carry on the business of machine tool makers, etc.

YORKSHIRE RANGE AND MANTEL COMPANY, LIMITED.—Capital £8,000, to acquire the Prospect Foundry, Otley Road, Shipley.

C. & L. SHAW, LIMITED.—Capital £5,000, to acquire the Huyton Quarry Iron and Steel Works, Huyton Quarry, Lancashire.

W. & L. COLE, LIMITED.—Capital £2,000, to carry on the business of engineers. Registered office: 123, Cannon Street, E.C.

CASTINGS, LIMITED.—Capital £6,000, to acquire the business carried on at Selborne Street, Walsall, as Alfred Bullows & Sons.

CHARLES WICKSTEED & COMPANY, LIMITED.—Capital £30,000, to acquire the ironfounding business carried on at Kettering by C. Wicksteed.

AUDLEY ENGINEERING COMPANY, LIMITED.—Capital, £10,000, to take over the business carried on at Newport, Salop, as the Audley Engineering Company.

THOMAS L. SCOTT & COMPANY, LIMITED.—Capital £10,000, to acquire the engineering business carried on by T. L. Scott, at 3, London Wall Buildings, E.C.

WILLIAM SHARPE & SON, LIMITED.—Capital £5,000, to acquire the engineering business carried on by Sharpe & Son. Registered office: 3, Bucklersbury, E.C.

LOUGHLIN MURPHY & COMPANY, LIMITED.—Capital £3,000, to acquire the engineering business of Loughlin Murphy. Registered office: 15, Fenwick Street, Liverpool.

ABERCOMBIE & SON, LIMITED.—Capital £2,000, to carry on the business of iron and brass founders. Registered office: 36, Whitfield Street, Tottenham Court Road, W.C.

HARRISON & COLMER, LIMITED.—Capital £5,000, to acquire the engineering business carried on at Bristol as Harrison & Colmer. Registered office: 67, Milk Street, Bristol.

ISAAC JENKS & SONS, LIMITED.—Capital £60,000, to acquire the Minerva and Beaver Iron Works, both in Wolver-

hampton, and the Staffordshire Works, West Bromwich.

M. J. STONEHOUSE, LIMITED.—Capital £3,000, to take over the Cefn Iron Works, Kenfig Hill, Glamorgan. Registered office: Adelaide Chambers, Adelaide Street, Swansea.

SMITH BROTHERS (LEICESTER), LIMITED.—Capital £10,000, to take over the engineering business carried on at Batten Street, Aylestone Road, Leicester, as Smith Brothers (Leicester).

THE ALNWICK FOUNDRY AND ENGINEERING COMPANY, LIMITED.—Capital £5,000, to acquire the business at Alnwick, Northumberland, of the Alnwick Foundry and Engineering Company.

SEAGERS, LIMITED.—Capital £30,000, to acquire the business carried on as L. J. & C. Seager, and to carry on the business of engineers, boilermakers, etc. Registered office: Overy Street, Dartford.

THOMAS JACK & COMPANY, LIMITED.—Capital £3,500, to acquire the business of Thomas Jack & Company, brassfounders and brass-finishers, 112 & 114, Dundas Street, South Side, Glasgow.

DORINDA ENGINEERING WORKS, LIMITED.—Capital £3,000, to take over the business carried on by J. R. S. Hayes, at 48A, Dorinda Street, Barnsbury, N. Registered office: 48A, Dorinda Street, Barnsbury, N.

C. H. MASON, WILSON & COMPANY, LIMITED.—Capital £1,000, to acquire the engineering business carried on by C. H. Mason and F. T. Wilson, at Gateshead. Registered office: 18, West Street, Gateshead-on-Tyne.

REAL, MEDLAND & WILLS, LIMITED.—Capital £4,000, to take over the business of engineers, etc., carried on by A. V. Real, J. Medland, and V. J. Wills, at Bridgwater. Registered office: St. Mary Street, Bridgwater.

LEADBEATER & GILL, LIMITED.—Capital £2,000, to acquire the business carried on at Holbeck Lane, Leeds, as Leadbeater & Gill, and to carry on the business of hydraulic, mechanical, and electrical engineers, etc.

SYDNEY SMITH & SONS, LIMITED.—Capital £30,000, to acquire the business of brass founders and finishers, etc., carried on as Sydney Smith & Sons. Registered office: Egypt Road, New Basford, Nottingham.

PERSONAL.

THE late Mr. R. Howie, ironfounder, Kilwinning, left estate valued at £11,299 gross.

THE EARL OF DUDLEY, who has been to the West Indies, has now returned to this country.

SIR THOMAS ROE, M.P., has resigned his chairmanship of King, Howman & Company, Limited.

MR. A. TURNBULL has been appointed commercial manager of the Grangemouth Iron Company, of Falkirk.

MR. F. SMITH, of Messrs. Smith & Coventry, engineers, Salford, has been appointed local Japanese Consul.

MR. F. R. BOOTH has been elected managing director of the Kelham Rolling Mills Company, Limited, Sheffield.

MR. J. A. ARNOLD, director of Eastwood, Swingler & Company, Limited, ironfounders, Derby, has resigned.

THE late Mr. J. R. Whitfield, secretary to the Taymouth Engineering Company, Carnoustie, left estate valued at £1,010.

WALLACH BROS., LIMITED, have removed their London offices to Royal London House, Finsbury Square, E.C.

E. BENNIS & COMPANY, LIMITED, have decided to further enlarge their new works at Little Hulton, near Bolton.

MR. A. H. MOULD, manager of the works department of Thomas Holcroft & Son, Limited, Wolverhampton, has resigned.

MR. H. S. JEFFERIES, of Messrs. Ransomes, Sims & Jefferies, Ipswich, has been elected a member of the local Chamber of Commerce.

THE late Mr. J. Powell, proprietor of Hills' Anvil and Smith's Tool Manufactory, Birmingham, left estate of the value of £31,761.

MR. W. W. HELM, senior director of F. Helm, Limited, ironfounders, Padiham, recently met with a serious accident, breaking his ankle.

MR. W. MATHIESON, of Wilsons & Mathiesons, Limited, Leeds, has been elected President of the United Kingdom Light Castings Association.

MR. W. A. SIMPON has been appointed London manager to Blackstone & Company, Limited, with offices at 81, Cannon Street, E.C., and 4, Budge Row, E.C.

MR. A. WESTLAKE, son of the managing director of the Staveley Coal and Iron Company, Limited, has been appointed commercial manager of the company.

MR. W. CARMICHAEL PEEBLES (Bruce Peebles & Company, Limited) has been elected a director on the Edinburgh Board of the Canada Life Assurance Company.

MR. B. A. FIRTH has been elected deputy-chairman of John Brown & Company, Limited, and Mr. W. H. Ellis has been elected a director of the company.

SIR ALFRED HICKMAN, BART., has been the recipient of an illuminated address in appreciation of his services as member of Parliament for Wolverhampton West.

MR. R. G. N. MARKHAM, formerly connected with the Thornycroft Steam Wagon Company, Limited, has been appointed general manager to Tangent Wheels, Limited.

A MOVEMENT has been initiated to permanently commemorate the services rendered to the City of Birmingham by the late Sir Richard Tangye and his brother, Mr. G. Tangye.

MR. DANKS has retired from the managing directorship of the Silverdale Company, to devote the whole of his time to his business of engineer and valuer in connection with the iron, steel, and tinplate trades.

MR. A. W. PATTIE at one time manager to Messrs. Hutson & Sons, Kelvinhaugh Engine Works, has been appointed manager to Messrs. Walker, Henderson & Company, Bishop Street Engineering Works, Glasgow.

MR. J. T. COLLINS has resigned his directorship of the Birmingham Railway Carriage and Wagon Company, Limited, and has been succeeded by Mr. R. Gould. The Hon. F. C. Stanley has been elected to a seat on the board.

MR. R. JOBSON, SEN., of Messrs. R. Jobson & Company, engineers, and Mr. A. S. Purdon, managing director of Irvine's Shipbuilding and Dry Dock Company, Limited, have been made J.P.'s for the borough of West Hartlepool.

MR. J. A. LLOYD, of John Brotherton, Limited, Imperial Tube Works, Wolverhampton, and Mr. W. Bullock, of the Electric Construction Company, Limited, have been elected president and vice-president respectively of the Wolverhampton Chamber of Commerce.

MONSIEUR CAMILLE HERWEGH, assistant manager of the Pyle and Blaina Company's Works at Blaina, who has left for France to undertake a managerial appointment at Pompey, near Nancy, has been the recipient of a presentation from the officials and men at the works.

MR. L. D. WHITEHEAD, the general manager of the Tredegar Company's Iron and Steel Works, has resigned that position to devote the whole of his time to the Deighton Iron and Steel Works, of which he is one of the proprietors. Mr. Whitehead will be succeeded by Mr. J. F. Gillott.

MR. J. A. REAVELL, formerly general manager of the Blake and Knowles Steam Pump Works, has resigned his directorship of the Worthington Pump Company consequent on his appointment as general manager to Messrs. Manlove, Alliott & Company, of Bloomsgrove Works, Nottingham.

MR. A. E. PEASE has been appointed a director of the North-Eastern Railway Company in place of the late Sir David Dale. Mr. Pease is the chairman of Pease & Partners, Limited, a post to which he was appointed on the resignation of Sir David Dale about three months ago.

MR. F. B. SINCLAIR has resigned the membership of the Sheffield branch office of the British Westinghouse Electric and Manufacturing Company, Limited, in order to take up an appointment with Messrs. Bruce Peebles & Company, as manager of their Newcastle office, Pape's Buildings, Neville Street, Newcastle-on-Tyne.

—o—

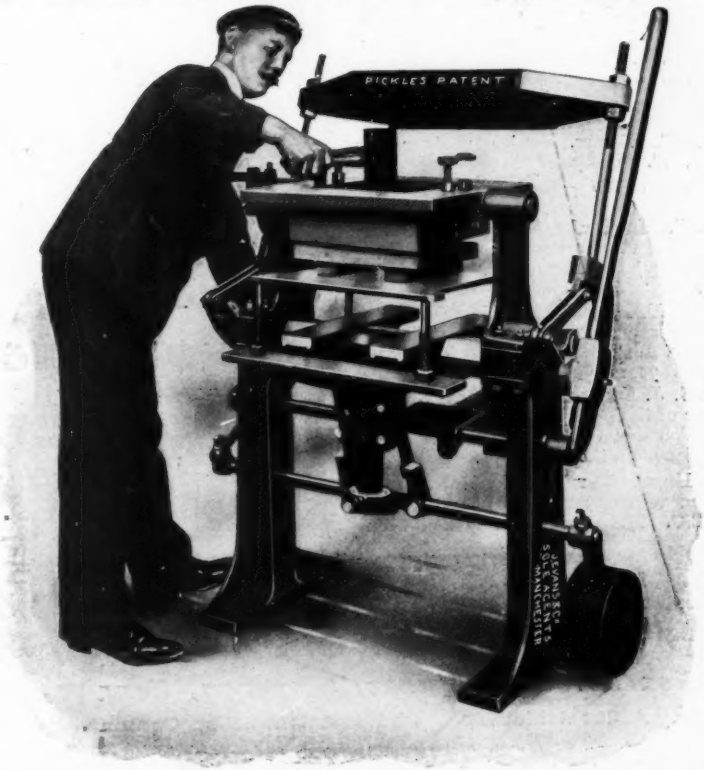
A WATER softening and heating plant, to deal with 15,000 gallons of water per hour, will shortly be installed at the works of the Barrow Hematite Steel Company, Limited, by Joseph Wright & Company, of the Neptune Engineering Works, Tipton, who also have heating and purifying plants on order for Messrs. Steel, Peech & Tozer, 20,000 gallons per hour; Messrs. Cammell, Laird & Company (third installation), 7,000 gallons per hour; the Universal Tube Company; Messrs. Robey & Company, and several other firms.

NEW MOULDING MACHINE.

PICKLES' PATENT.

ASK FOR LIST AND FULL PARTICULARS.

COMPLETE FOUNDRY EQUIPMENT.



JAMES EVANS & CO.,

Britannia Works, MANCHESTER.

TELEGRAMS: "LADLES, MANCHESTER." "BLACKINGS. GLASGOW." TELEPHONE: 2297, MANCHESTER. 3185, BRIDGETON, GLASGOW.

DEATHS.

MR. G. DANCE, brassfounder, of Hunslet, Leeds, at the age of 65 years.

MR. J. N. MITCHELL, formerly manager of Harrison & Camm, Limited, the Wagon Works, Holmes.

MR. G. COCKBURN, managing director of Cockburns, Limited, engineers, Cardonald, near Glasgow.

MR. J. W. DAVIDSON, formerly connected with the Kirkstall Forge Company, Limited, of Leeds, aged 45 years.

MR. G. GREGORY, last surviving partner of Messrs. Mycroft & Gregory, the Union Foundry, Birmingham, aged 83 years.

MR. C. H. BAILEY, J.P., owner of the Tyne Engineering Works, Newport, and of similar works at Barry, aged 60 years.

MR. W. R. NEIL, a director of Fletcher, Russell & Company, Limited, gas stove manufacturers, Warrington and Pendleton.

MR. C. BERRY, senior partner of Messrs. F. Berry & Sons, engineers, Sowerby Bridge, Halifax, in his 52nd year.

MR. J. HIRD, who for nearly half his life had been manager to Messrs. Scriven & Company, engineers, of Marsh Lane, Leeds.

MR. G. E. MACKROW, naval architect to the Thames Iron Works and Shipbuilding Company, Limited, of Blackwall, at the age of 77 years.

MR. S. J. COCKBURN, for many years a director of the Seaham Harbour Iron and Brass Foundry Company, Limited, near Sunderland, at the age of 77.

MR. HENRY AUSTIN, of the Hope Foundry Company, Upper Thames Street, London, E.C. The deceased, who had been suffering from an attack of pneumonia, was in his 64th year.

MR. J. S. CUMBERLAND, who was formerly connected with the Bowling Iron Company, Limited, and later represented the Weardale Steel, Coal and Coke Company, Limited, in London.

MR. ERNEST GEARING, managing director of the Leeds Forge Company, Limited, after a very brief illness. The deceased gentleman was 57, and had but recently been appointed director. He became general manager of the Leeds Forge Company in 1892.

—o—

CASTINGS, LIMITED, Beacon Works, Walsall, have acquired the foundry business of Messrs. Alfred Bullows & Sons, Walsall. The firm are making extensive alterations and putting in a sand-blast plant so as to bring the foundry, which will be under the same management as for the past 25 years, thoroughly up-to-date. This will not interfere in any way with the business carried on by Messrs. Bullows at Long Street, where they will continue to manufacture all kinds of buckles, cabinet ironfoundry, etc.

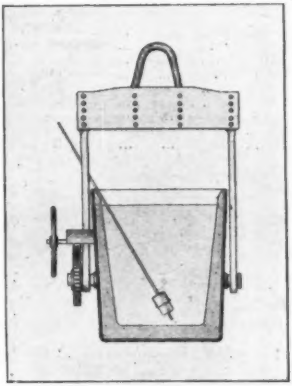
Patterns
—and—
Core Boxes

FRED HIRST,
Phœnix Pattern Works,
HUDDERSFIELD.

Ganister, Cupola Blocks, Fire Bricks,
Fire Clay.
Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.
Steel Moulders' Composition, Silica Cement.

J. GRAYSON LOWOOD & Co., Ltd.,
DEEPCAR, nr. SHEFFIELD.
Telegrams: "LOWOOD, DEEPCAR."

PREVENTION OF BLOWHOLES IN CAST IRON.



A tin of our special compound fixed on a rod is held at bottom of ladle as shown; a strong re-action being thereby set up frees the iron from gases and impurities, which rise to the top.

RESULT: A denser casting of finer grain with increased strength.

For Particulars apply to—

THERMIT LIMITED,

27, MARTIN'S LANE, CANNON STREET,

Telephone—3749 Central.
Telegrams—"Fulmen," London.

LONDON, E.C.

ELDERS FOUNDRY COKE

As supplied to the British . . Admiralty Dockyards.

The following, selected from numerous letters, are eminent testimony as to the quality of our celebrated "A.A.A." Coppee Foundry Coke, carefully selected, and despatched in sheeted wagons.

From PECKETT & SONS, Bristol.

Bristol, October 25th, 1904.

We have been using your Selected Foundry Coke for some considerable time.
We have pleasure in stating that we are very pleased with it, as we find we get sounder and cleaner castings, more free from blow-holes and other defects, than we formerly did.

From MOUNTFORT PHILLIPS & Co., Llantrissant.

Llantrissant, October 25th, 1904.

In reference to the Foundry Coke you have been supplying us with for the last six months, we have very great pleasure in letting you know that it has given every satisfaction, and that our Works Manager and Workmen give it the highest praise.

Elders Navigation Collieries, LTD. Cardiff.

PRICES OF METALS.

The following table shows the approximate latest prices and position of stocks of metals during the past two years :—

METALS.	1905-6.	1904-5.
Iron—Scotch pig warrants ... ton	61/6	—
—Middlesbro' warrants ... ... ton	54/11½	48/11
—W.C. M/nos Bessemer ... ... ton	80/0	70/0
—Stock, Scotch, Feb. 28 ...tons	5,024	14,300
Copper—Chili bars, GMB ... ... ton	£108 7/6	£78 17/6
—Stock, Europe & afloat... ... tons	—	—
Tin—English ingots ton	£194 10/0	£167 0/0
—Straits ... ton	£191 15/0	£165 15/0
—Stock, Ldn. Hlnd and aflt ... tons	13,186	14,261
Lead—English pig ton	£19 17/6	£16 5/0
Spelter—Ord. Silesian ... ... ton	£25 2/6	£25 2/6
Quicksilver—(75lb.) bottle	£7 0/0	47 7/6
Antimony—Regulus ... ... ton	£103-£105	£68 0 0

*Settlement price.

CASTINGS.

In the Cleveland district the following are the nominal rates current for castings :—

	£ s. d.		£ s. d.
Columns (plain)	7 0 0	to	7 5 0
Pipes, 1¼ to 2½ in.	5 12 6	to	5 17 6
,, 3 to 4 in.	5 5 0	to	5 12 6
,, 5 to 8 in.	5 2 6	to	5 5 0
,, 10 to 16 in.	5 2 6	to	5 5 0
,, 18 to 24 in.	5 2 6	to	5 5 0
Chairs	4 2 6	to	4 5 0
Floor plates (open sand)	3 10 0	to	3 12 6

SCRAP.

The quotations for scrap, subject to market fluctuations, are as follows:—Heavy wrought (mixed), £3; light wrought, £1 15s.; heavy cast, £1 12s. 6d.; all per ton f.o.b., London. Copper (clean), £99; brass (clean), £67; lead (usual draft), £18; tea lead, £16 5s.; zinc, £21; all per ton delivered merchant's yard.

SILICA FIRE BRICK CO.,

OUGHTIBRIDGE.

GROUND GANISTER,

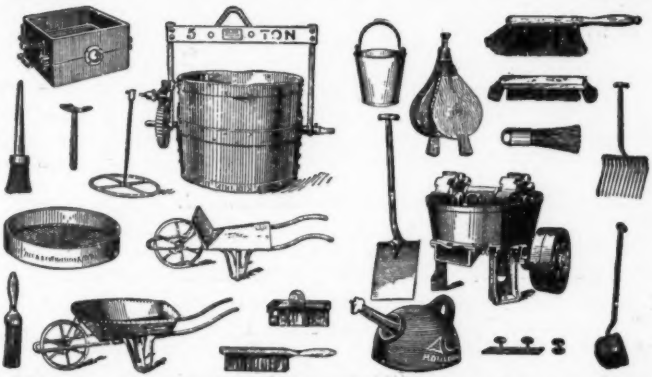
Wet or Dry.

Silco Cupola Bricks, 90 % Silica.

Better than Fire-clay Bricks for Cupolas.

Established 1863.

Jas. Durrans & Sons,



PHŒNIX WORKS, PENISTONE, Near Sheffield.

Manufacturers of all

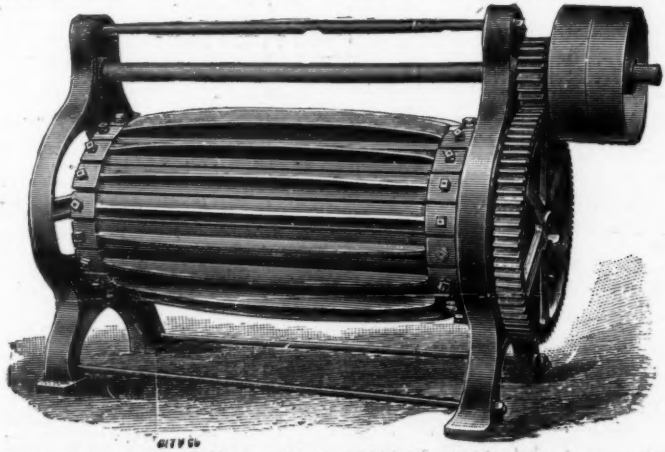
FOUNDRY EQUIPMENTS,

Composition Black Lead,

Plumbago, Core Gum, White Dust, and Coal Dust.

Ladles, Cupolas, Fire Bricks, Gannister, Stone Flux, Loam and Sand Mills, Casting Cleaners, Studs, Chaplets, Pipe Nails, Sprigs, Brushes, Wire Brushes, Core Ropes, Bellows, Buckets, Spades, Forks, Riddles, Sieves, Barrows, &c.

IMPROVED FOUNDRY RATTLER or FETTLING DRUM.



These Machines are invaluable for a Foundry, doing a larger amount of work of a superior quality, in a much shorter time than can be done by hand, without skilled labour.

"Dear Sirs,—We have been using your best Blacking for a large number of years, and always use it on our large Ingot Moulds, which, as you know, we have made up to 85 tons in weight.

"Yours faithfully, THE BRIGHTSIDE FOUNDRY & ENGINEERING CO., LD."

The most successful Foundry Specialities are

THE PIFTIN SPECIALITIES.

The Piftin Specialities are in universal favour with Founders both large and small, and are in constant use throughout the World.

The reason of their great and continued success is that each Speciality handled by us is proved to be a practical success *before* it is placed on the market.

It costs us a lot of money, time, and trouble to ensure this, but then it enables us to fully satisfy our buyers, and we thereby gain what we aim at—The repeat orders of our numerous clientele, both at Home and Abroad.

If, therefore, you are wanting anything for your Foundry, you should get the best of its kind, which is the *PIFTIN.*

The Piftin High Pressure Blower

Over 80 have been supplied to H M. Government.

The Piftin Portable Mould Drier

In use throughout the World, including the principal British and Continental Foundries.

The Piftin Sand Renovating System

Saves 80% of the yearly sand Bill.

The Piftin Sand Mixing Machine

The most efficient machine on market.

The Piftin Sand Blast Machinery

Adapted for all purposes.

Up-to-d.te in every respect. The most efficient, most simple, and most easily worked of any apparatus on the market. Saves the entire cost in the first few months.

For further particulars apply to

PIFTIN LIMITED,

143, 145 & 147, ROSEBERY AVENUE,

PLEASE NOTE NEW ADDRESS. **LONDON, E.C.**

SITUATIONS VACANT.

FOUNDRY MANAGER Wanted for large Works in Scotland (Scotch Light Castings). Must be a thoroughly practical and experienced man, and well up-to-date in methods of working and piece-work prices. Applications will be treated with strict confidence.—Applicants, who must be energetic, prompt 6 o'clock a.m. men, will please state age, experience, and salary required, to "G.B." c/o STREETS, 30, Cornhill, London.

FOR SALE AND WANTED.

FOR SALE, "ROOT'S" PATENT BLOWERS.

No. 1a size, "Allday's," 6 in. outlet, £18.
No. 1 ,, ,, 7 in. ,, £19.
No. 2 ,, "Thwaites," 8 in. ,, £20.

with Engines and Boilers to drive.
Address J. LIGHT, Wolverhampton.

ONE 5-Ton Foundry JIB CRANE (for hand), 11 ft. high, 14 ft. radius, for Sale, in good condition. Price £25, at Peterborough Station.—Apply BARFORD & PERKINS. Peterborough.

TO BRASS FOUNDERS & ENGINEERS, —Complete Analysis of any Alloy, 25s.—L. PARRY, A.R.S.M., Union Bank Yard, Huddersfield. Speciality—Brasses, Bronzes, Anti-Friction Metals. 12 years' experience.

PNEUMATIC TOOL PLANT for Sale.—Belt-driven air compressor, patent governor, receiver, piping, two Kotten tools, nearly new; cheap.—LOMAS, 41, King-street, Derby.

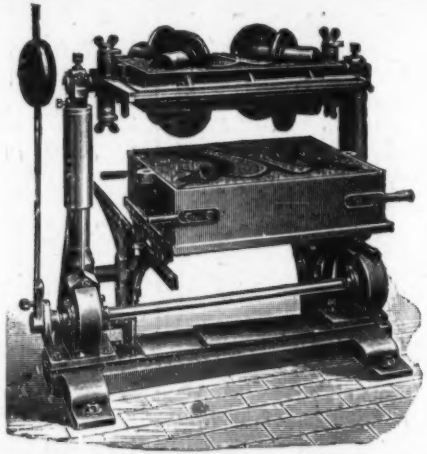
ROOTS' BLOWER, No. 5, steam-driven, capacity 6,400 cubic feet of air per minute; has been very little used, and is in perfect condition; cheap to clear.—JOSEPH PUGSLEY, St. George, Bristol.

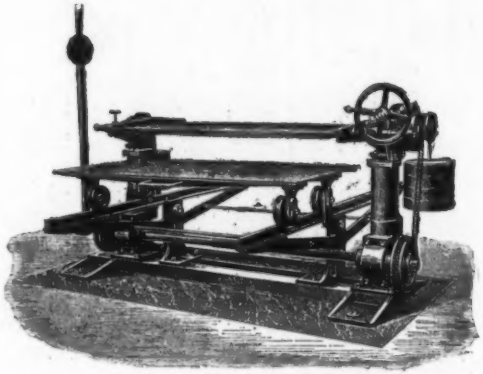
STIGNIC PAINT.
NEWEST AND BEST WASH FOR STEEL FOUNDERS.
PLASTIC CUPOLA GANISTER.
FINEST MATERIAL FOR LINING CUPOLAS AND FURNACES AND SETTING FIRE-CLAY BRICKS.
SPECIAL **STEEL MOULDERS' COMPO.**
STEPHENS & CO., Kidwelly.

FOUNDRY EQUIPMENT.
PATENT CORE MAKING MACHINES
No linseed oil or flour required.
NEW PORTABLE MOULD DRIERS
Moulds dried on the spot in an hour to one hour and a half.
J. W. & C. J. PHILLIPS,
23, COLLEGE HILL, London, E.C.,
And 7, PARK SQUARE, LEEDS.

CUPOLA LININGS.
HIGH-CLASS QUALITY
FIRE BRICKS
Made from specially selected clays.
BEST CRUCIBLE CLAYS.
Blast Furnace, Hot Air Stove, Boiler Seating, Flue Cover, and other Best Fire Bricks.
JOHN HALL & CO.,
OF STOURBRIDGE, LTD.,
STOURBRIDGE.

STOURBRIDGE FIRE BRICKS
OF BEST QUALITY FOR LINING CUPOLAS.
— IN STOCK, ALSO MADE TO ANY DESIGN. —
Linings Stocked to Customers' Plans to ensure IMMEDIATE DELIVERY.
All kinds of Fireclay Goods of highest quality.
HARRIS & PEARSON, STOURBRIDGE.
Telegrams: "Fireclay, Stourbridge." Telephone: No. 7 Brierley Hill.





Hand Moulding Machines, with TURN-OVER PATTERN PLATES, constructed in all sizes for moulding boxes, from 16 in. by 12 in. to 87 in. by 24 in.

Sand Blast Machinery on an entirely new and improved process for ROTARY TABLES, TURNTABLES, CLEANING DRUMS, etc.

Catalogues on Application. *We can show you an Installation of Machines here.*

THE LONDON EMERY WORKS CO.,

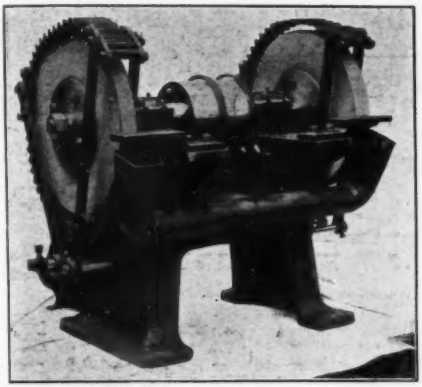
Park, Tottenham, London, N.

Telephone No. 47 Heaton Moor.

MANUFACTURERS OF

Telegraphic Address: "Heroic, Reddish."

Crystal Canadian Corundum,



CARBO CORUNDUM

AND

EMERY WHEELS,

For Foundry Use

ALSO

ALL CLASSES OF

GRINDING . . MACHINES. . .

Send for Catalogue and Prices.

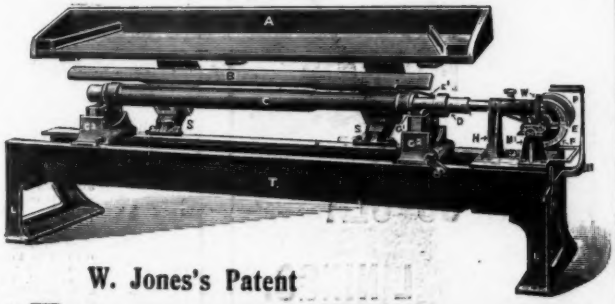
B. R. ROWLAND & CO., LTD.,

REDDISH, Near STOCKPORT.

A REVOLUTION IN

Pipe Foundry Practice

For Pipe Cores, 18 ft. long and 2 in. to 20 in. diameter.



W. Jones's Patent

CORE FORMING MACHINE

JONES & ATTWOOD,

STOURBRIDGE, ENGLAND.

PNEUMATIC PLANT

OF ALL KINDS AND FOR ALL PURPOSES.

Air Compressors, Vacuum Pumps, Receivers, Chipping, Riveting & Caulking Hammers, Drilling Machines, Grinders, Forges, Hoists, Spraying Machines, Painting Machines, Sand Blasting Machines, Sand Shifters, Air Lift Water Pumps, Hose, Fittings, etc.,

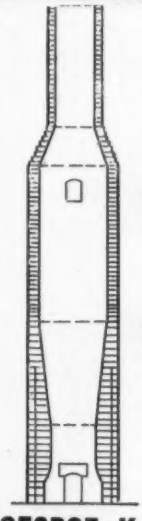
OF BEST BRITISH MANUFACTURE.

LACY-HULBERT & CO., Ld.,

. . . **Pneumatic Engineers,** . . .

91, VICTORIA STREET, LONDON, S.W., and

BOREAS WORKS, BEDDINGTON, Surrey.



Special . .

Quality . .

FIREBRICKS

. for .

CUPOLA LININGS.

GEORGE K. HARRISON, Ltd.

Fireclay Brick Works,

STOURBRIDGE.

38½"
McNEIL'S
PATENT UNBREAKABLE
STEEL LADLES
These Ladles are manufactured by a patented process, each from a single steel plate without weld or rivet. They are extremely light, being at the same time the strongest and most durable in the market. Ladles to contain 56 lb. of metal only weigh about 7 lb. each. They are made of all capacities from 30 lb. to 60 cwt., with or without lips; also mounted or unmounted. They are also suitable for chemical and metallurgical processes. List of sections and prices on application to
CHAS. McNEIL.
KINNING PARK IRONWORKS,
GLASGOW.
38"
32½"

Can also be made in Aluminium.

Telegrams—
"Tuyere, Manchester."

ON ADMIRALTY LIST.

National Telephone—
No. 70, Openshaw.

T. DAVIES & SON,

Railway Ironworks,

WEST GORTON, MANCHESTER.

ESTABLISHED 1876.

Agents for London district:—The Simplex Coke Oven and Engineering Co., Ltd., Temple Bar House, London, E.C.

Agents for Scotland:—The Simplex Coke Oven and Engineering Co., Ltd., 144, St. Vincent St., Glasgow.

The above illustration represents a Complete Melting Plant, consisting of Rapid Cupola to melt 5 tons per hour, Charging Platform with a storage capacity of 150 tons, Electrically driven Blower and Hoist.

Speciality:— FOUNDRY CUPOLAS OF ALL TYPES,

UPWARDS OF 500 MADE AND SOLD,

CHARGING PLATFORMS.

COMPLETE MELTING PLANTS SUPPLIED.

FIRST CLASS PATTERN PLATES

are now being made by moulders in foundries, with

WHITE'S PATTERN PLATE APPARATUS

without the aid of any expensive machine tools.

No method of making repetition work in foundries **is complete without** a simple ready system of making pattern plates as required for either hand or machine moulding.

White's syst m completely meets these requirements. Write for illustrated pamphlet, to

EDW. WHITE, Windsor Works, Redditch.

ON ADMIRALTY LIST. London Office: W. Littleton, 9, Fe church Street, E.C.

ON ADMIRALTY, WAR OFFICE, AND INDIA OFFICE LISTS.

BLACKINGS

(Iron Moulders).

STRAW ROPES and other Foundry Requisites.

THOMAS WILKINSON & CO., LTD., MIDDLESBROUGH.

CHAS. HALL,

Foundry Requisite Maker,

DANTZIC ST., MANCHESTER.

STEEL WIRE BRUSHES.

Chaplets and Studs a Speciality.

COLD BLAST PIG-IRON.

M. & W. GRAZEBROOK,
DUDLEY.

FOUNDRY REQUISITES.

BRUSHES,	CHAPLETS & STUDS,	LADLES,
BELLOWS,	CEMENT,	RIDDLES & SIEVES,
BUCKETS,	CORE GUM,	SPADES, SPRIGS,
BARROWS,	CORE ROPE,	TERRA FLAKE,
BLACKING,	CORE TAPER,	FERRO-ALUMINIUM,
COAL DUST.	CRUCIBLES,	ETC.
	CUPOLAS,	

MOOR & SONS, 1, Fennel St., MANCHESTER, (Dept. F.)

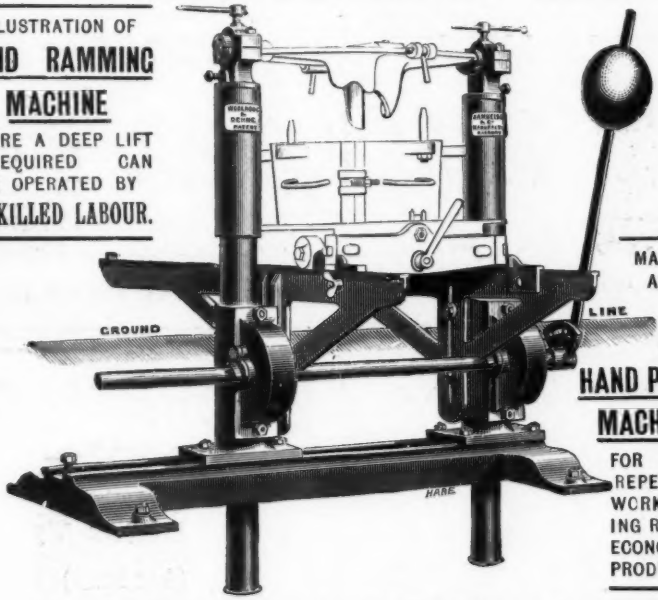
Established 1857. Telegrams "Acklam." Telephone, No. 3566.

IMPORTANT TO IRONFOUNDERS

MOULDING MACHINES

FOR REPETITION FOUNDRY WORK.

ILLUSTRATION OF
HAND RAMMING MACHINE
WHERE A DEEP LIFT IS REQUIRED CAN BE OPERATED BY
UNSKILLED LABOUR.



MAKERS ALSO OF A
NEW HAND PRESS MACHINE
FOR SMALL REPETITION WORK, GIVING RAPID & ECONOMICAL PRODUCTION

MOST EFFICIENT and ECONOMICAL IN USE.

ALSO MAKERS OF **ROOTS' "ACME" BLOWERS**

FULL PARTICULARS FROM—

SAMUELSON & CO., LTD., BANBURY,
ENGLAND.

SEE OUR ADVERTISEMENT EVERY ALTERNATE MONTH.

2

STOURBRIDGE FIRE BRICKS

OF BEST QUALITY FOR LINING CUPOLAS

— IN STOCK, ALSO MADE TO ANY DESIGN. —

Linings Stocked to Customers' Plans to ensure IMMEDIATE DELIVERY.
All kinds of Fireclay Goods of highest quality.

HARRIS & PEARSON, STOURBRIDGE.

Telegrams: "Fireclay, Stourbridge." Telephone: No. 7 Brierley Hill.

CUPOLA LININGS.

HIGH-CLASS QUALITY

FIRE BRICKS

Made from specially selected clays.

BEST CRUCIBLE CLAYS.

Blast Furnace, Hot Air Stove, Boiler Seating, Flue Cover, and other Best Fire Bricks.

JOHN HALL & CO,

Of Stourbridge, Ltd.,

STOURBRIDGE.

Patterns

— and —

Core Boxes

FRED HIRST,

Phœnix Pattern Works,

HUDDERSFIELD.

FOUNDRY EQUIPMENT.

THE RAPID "ECONOMIC" CUPOLA.

CORE MACHINES (Rotary and Piston Types).

CORE STOVES (Hislop's System).

"LEEDS" HANDPRESS MOULDING MACHINE.

"LEEDS" COMBINATION (Hand Press and Turn-over) MOULDING MACHINE.

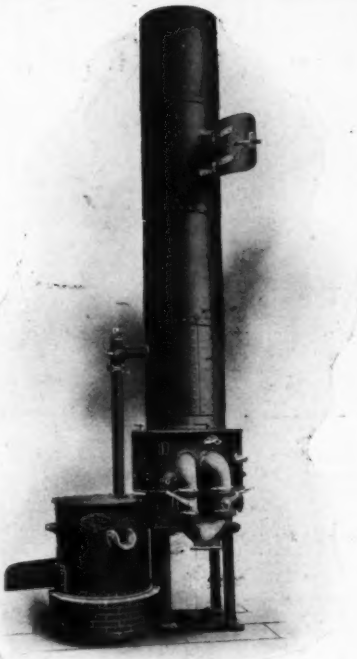
PORTABLE MOULD DRIERS.

SAND MILLS. FOUNDRY SUNDRIES.

Write for Catalogue to

HORACE P. MARSHALL & CO., LEEDS.

FOUNDRY PLANT.



Cupolas,
with or without receivers or drop bottoms.

Roots' Blowers,
belt, steam-engine, or electro-motor driven.

Charging Platforms, Hoists, and Ladles.

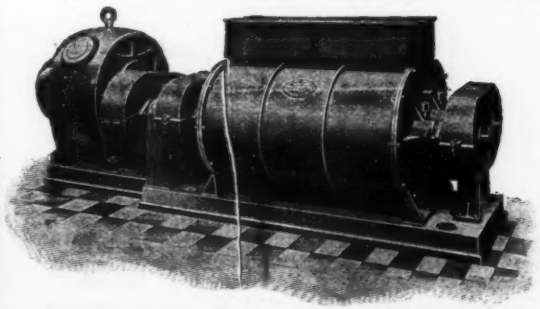
ECONOMICAL RESULTS GUARANTEED.

We are also Manufacturers of Steam Hammers, Smiths' Hearths, Centrifugal Pumps and Fans, High-Speed Engines, and the "Bradford" Patent Boiler Feed Pump.

CONTRACTORS TO HIS MAJESTY'S GOVERNMENT.

THWAITES BROS., LTD.,

Vulcan Ironworks, BRADFORD.



Telegrams —
"THWAITES, BRADFORD."

Telephone:—
No. 325 BRADFORD.

London Office—
96 & 98, Leadenhall Street, E C.

CATALOGUES ON APPLICATION.

Evans' Rapid Cupolas.

ON ADMIRALTY LIST.

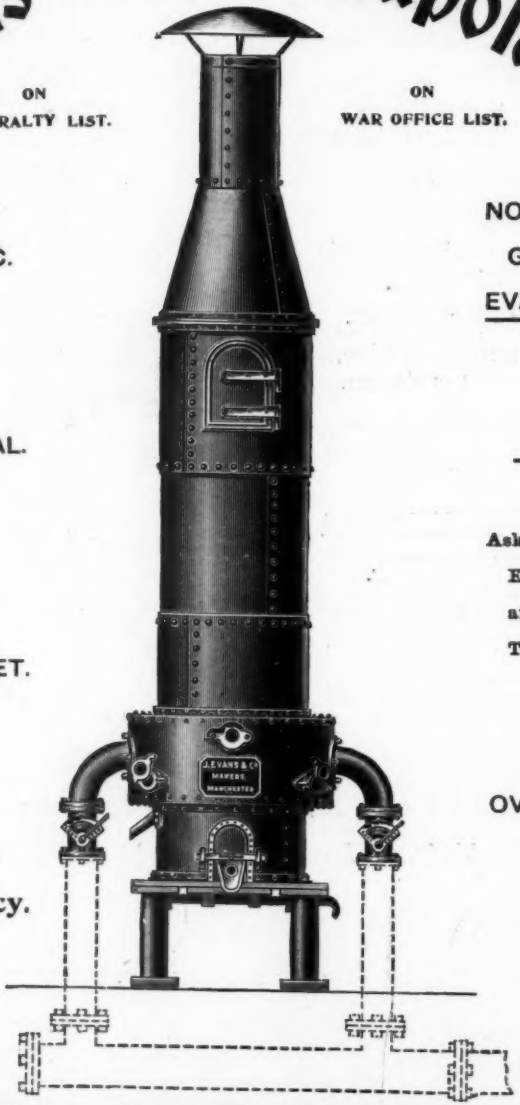
ON WAR OFFICE LIST.

MOST SCIENTIFIC.

MOST ECONOMICAL.

BEST IN THE MARKET.

Highest melting efficiency.



NONE SO GOOD AS EVANS' RAPID.

Ask for Estimates and Copy Testimonials.

OVER 400 IN USE.

Telegrams: "LADLES, MANCHESTER."

Telephone: 2297 Nat., Manchester.

JAMES EVANS & CO.,

Britannia Works, Manchester.